

THE JOURNAL

OF

THE DEPARTMENT OF AGRICULTURE,

VICTORIA, AUSTRALIA.

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DEPARTMENT OF AGRICULTURE, VICTORIA

RED POLL DAIRY HERD

BULL CALVES FOR SALE

TO VICTORIAN DAIRYMEN

(Note.—In order to lessen correspondence it is notified that the Department has no Red Polls for sale other than the calves notified hereunder. All the earlier bull calves have been sold, and choices from cows still to calve this season have been booked. The demand for bull calves is so strong that farmers contemplating purchase are advised to study the records of the herd published in the September (1915) *Journal of Agriculture* and book their orders ahead, stipulating choice of bull calves from, say, three of the record cows.)

DAM.	Date of Birth.	RECORD OF DAM.				PRICE.
		Milk lbs.	Average Test.	Fat lbs.	Butter lbs.	
	Sired by "NICOTINE" by ACTON DEWSTONE (imp.)					
Samorna* ...	12.6.15	5490	4.9	271.76	309½	13 Guineas
Kentucky ...	22.8.15	7904	3.96	313.25	357	15 ..
Egypta ...	17.9.15	10646	3.9	418.55	477	20 ..

* Record as heifer on first calf.

The prices are based approximately on the actual milk and butter fat record of the dam at the rate of 1s. per lb. of butter fat yielded.

For Description and Record of the Herd see Journal of Agriculture, September, 1915.

Inspection of the Herd is invited.

Visitors will be met at the Station on notification to:—

Mr. R. R. KERR, Dairy Supervisor

— or —

Mr. ED. STEER, Herdsman

} State Research Farm, Werribee.



THE JOURNAL
OF
The Department of Agriculture
OF
VICTORIA.

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DRY-FARMING INVESTIGATIONS IN THE UNITED STATES.

By Lyman J. Briggs, M.S., Ph.D.

In charge of Biophysical Investigations, United States Department of Agriculture.

Presented before Section M of the British Association for the Advancement of Science, Melbourne, Australia, 1914.

(Continued from page 455.)

Influence of the Distribution of Rainfall on Farm Practice.

The different distribution of the rainfall in the inter-mountain district and in the Great Plains, has led to interesting differences in the farm practice of these regions.

Spring wheat is not a successful crop in the inter-mountain district, for two reasons: (1) The land cannot be fitted for sowing until late in the season, owing to the spring rains; and (2) the driest part of the season occurs when the spring wheat crop is maturing. A large acreage of winter wheat is, however, grown. In fact, the dry-farming activities of this section are devoted almost wholly to the growing of winter wheat. The stubble is not usually ploughed until spring, the land being very dry and hard in the fall. The stubble also keeps the winter snows from drifting, and thus holds the precipitation on the land. As soon as the spring rains have ceased, the stubble and the early growth of weeds are turned under, and the land is kept fallow until the following autumn. The low rainfall during the summer makes it possible to destroy the weed-growth, and maintain an efficient surface-mulch, at a comparatively low cost. In the autumn, wheat is again sown. The crop makes

a good part of its growth while the temperature is cool and the evaporation low, and, in addition to the stored moisture, has the advantage of the seasonal precipitation during its growth period.

One serious difficulty in dry-farming operations in regions of winter rainfall occurs in connexion with the seeding of winter wheat on fallow land. The surface mulch of the fallow is often dust-dry in the fall to a depth of 4 inches or more. If the farmer drills his grain in the dust, the seed remains inert until a rain occurs. If the first rain is insufficient in amount to soak through the dry mulch to the damp soil below, the seeds germinate, but the rootlets of the seedling plants do not reach the stored moisture below the intervening dry layer, and the plants soon die. On this account, farmers usually wait for fall rains before sowing wheat. If the seeding is thereby delayed until late in the fall, and freezing weather follows, the young plants are injured and weakened. And if this is followed by an "open winter," so that the wheat plants are not protected by a covering of snow, "winter killing" is often very severe, and the crop is practically a failure.

Drilling the wheat to a depth sufficient to place the seed in moist soil would appear to be a possible solution of this problem, but this is often found impracticable, and the seedling plants have great difficulty in forcing their leaves to the surface. It is possible that a solution of the difficulty may be found in a seed-drill which has recently been developed, which throws the dry surface soil in ridges, and plants the grain in moist soil at moderate depths in the intervening furrows. This plan is not practicable in windy regions, for the furrows would soon fill with dry soil.

In striking contrast with inter-mountain practice, spring wheat is grown extensively in the Great Plains, especially in the central and northern part. The spring-sown crop escapes the dry fall and all danger from winter-killing, while the land, having been recently worked, is in better condition to absorb the summer rainfall. Inter-tilled crops are also grown to a much greater extent than in the inter-mountain district, maize being especially popular in the northern part of the Great Plains, and the sorghums (milo, kafir, sorgo) in the southern part. The inter-tilled crop has in many sections largely taken the place of fallow, spring wheat now being extensively grown on disked corn land.

Fallow is used extensively in the Great Plains, but experiments by the Office of Dry Land Agriculture, under the direction of E. C. Chilcott,* have shown that alternate cropping and summer tillage in many sections is less profitable than simple three-year rotations, especially those in which spring wheat is grown on disked corn land, and even less profitable than continuous cropping. Summer tillage is not so well adapted to a summer rainfall as to a winter precipitation, for the summer rains repeatedly pack the mulch, which necessitates frequent cultivation to keep the land in a receptive condition, and to destroy the weeds which spring up after each rain. Summer tillage, however, affords some insurance against total loss of a crop during a dry season, which means disaster to the farmer with work-animals and cows to feed; and this element of insurance will doubtless always be a factor with the small farmer, even if summer tillage does not give the greatest returns.

* A study of crop rotations and cultivation methods for the Great Plains area.—United States Department of Agriculture, Bureau of Plant Industry, Bulletin 187, page 8, 1910.

Owing to the frequent high winds in the Plains, the blowing of the mulch on summer-tilled land sometimes becomes a serious problem. It is highly important, in fallowing the Plains, to keep the surface of the soil in a rough condition; in other words, to maintain a clod-mulch on the fallow rather than a dust-mulch, a practice which is also advantageous in the absorption of rainfall. On lands subject to blowing, the practice of cultivating in strips is sometimes followed. The strips are laid out at right angles to the prevailing winds, and alternating strips are planted to grain or an inter-tilled crop. Jardine* has recently emphasized the value of the lister in checking blowing in extreme cases. This implement opens a broad shallow furrow, throwing the dirt on both sides. Groups of two or three furrows each are listed at distance of from 5 to 20 rods across the field at right angles to the wind. The lister tends to form clods, while the disk-harrow, except in moist ground, tends to pulverize the soil, and this must always be avoided in soils subject to blowing.

Depth of Root System in Relation to Storage of Soil Moisture.

The great depth to which the roots of many of our cultivated plants extend has a very important bearing on the practicability of storing moisture in the soil. Burr† has found that oats, spring wheat, barley, and corn growing on the loose soils of eastern Nebraska use the water to a depth of 4 feet or more, while winter wheat feeds to a depth of 6 or 7 feet. Excavations made in winter wheat plots in Utah showed the root system to extend to a depth of 7 feet.‡

In a soil which can store 6 per cent, of "growth water," there would be available, in a section 6 feet in depth, 600 tons of water per acre, or enough for the production of 13 bushels of wheat in the central Great Plains.§ For a root penetration of 4 feet, this amount would be reduced approximately one-third.

When the system of alternate cropping and fallowing is employed, water seldom moves below the zone occupied by the roots of the wheat plant. This has taken place, however, at the Dickinson Experimental Farm in western North Dakota. The water which moves below the feeding zone is practically lost to the plant, and remains undisturbed from year to year. An argument often advanced in favour of deep ploughing is that the depth of root penetration is thereby increased. The futility of this argument, so far as dry-farm soils are concerned, becomes evident when it is realized that the normal penetration of roots in the inter-mountain and Great Plains soils is far below any depth that could possibly be reached with the plough. Deep ploughing may possibly increase the absorption-rate of rainfall when the precipitation-rate is so high as to saturate the surface soil temporarily; but this effect can also be secured by leaving the surface rough and corrugated when cultivating. Many of the field tests of the Office of Dry Land Agriculture have failed to show any increase in yield from deep ploughing, an operation which means an added expense to an industry in which economy in labour must be rigidly exercised to show a reasonable profit.

* *Trans. Am. Soc. Agron.* 5, 213, 1913.

† Research Bulletin No. 5, Nebraska Experiment Station, 1914.

‡ Merrill.—Bulletin 112, Utah Experiment Station, 1910.

§ Briggs and Shantz. Relative water requirement of plants.—*Journal of Agricultural Research*, United States Department of Agriculture 3, 1, 1914.

Loss of Water from Weeds.

A relatively small proportion of the total annual rainfall is conserved in the fallow. The maximum quantity of stored moisture available for crop seldom exceeds 4 inches of rainfall in sections where the annual rainfall ranges from 13 to 18 inches. This low efficiency is due in part to loss from run-off, but mainly to surface evaporation, and to loss through the transpiration of weeds. Numerous measurements have shown that a rainfall of less than $\frac{1}{2}$ inch does not contribute to the permanent store of moisture in the soil unless the surface soil is already wet from previous rains. If the rainfall penetrates the soil below a depth of 6 inches, its rate of loss due to evaporation is low. But if the fallow is weedy, the stored water is lost through the transpiration of the plants almost as rapidly as if the moist subsoil were freely exposed to the air. The water requirement of weeds is fully as high as some of our most valuable crop plants. For example, pigweed (*Amaranthus retroflexus*), tumble-weed (*Amaranthus gracilis*), and Russian thistle (*Salsola pestifer*), have a water requirement as high as the millets and sorghums, while sunflower (*Helianthus petiolaris*), and lamb's quarters (*Chenopodium album*) rank higher than many of the legumes.* The dry-farmer can therefore produce a valuable forage or grain crop with no greater expenditure of water per pound of dry matter than is lost through the weeds on his fallow.

Determination by W. W. Burr,† in Nebraska; R. W. Edwards,‡ and J. G. Lill,§ in Kansas; and C. B. Burmeister,¶ in Texas, all unite in showing that the evaporation loss from land from which the weeds are sliced off with a hoe is but little greater than from cultivated plats. In other words, cultivation is effective in conserving water mainly through the destruction of weeds rather than in the reduction of surface evaporation. This is well illustrated by Lill's measurements at Garden City, Kansas, as shown in Figure 3. The moisture content of the mulched plat did not differ markedly from the plat on which the weeds were kept sliced off with a sharp hoe; while the plat on which the weeds were allowed to grow was dried out to a depth of 3 feet.

A striking example of the loss of moisture from weeds is also shown in experiments by P. V. Cardon,§ at Nephi, Utah. Winter wheat was grown on four plats by the summer fallow system, one-half the plats being in wheat each year. Two plats were fall-ploughed each year, and during the following summer, one plat was cultivated to destroy the weeds, while the other was left untouched, except to clip the weeds in time to prevent the seeds maturing. In the autumn, both plats were sown to winter wheat. The experiment was conducted for four years, and during this time the yield from the cultivated plat averaged 4 bushels more per acre than from the weedy plat.

The loss of moisture in these plats as the season advanced, due to the demand made by the weeds, is illustrated in the accompanying graphs, Fig. 4. That this loss is primarily due to the weed cover, and

* Briggs and Shantz.—*Journal of Agricultural Research*, United States Department of Agriculture 3, 60, 1914.

† Research Bulletin No. 5, Nebraska Experimental Station, page 61, 1914. In co-operation with the Office of Dry Land Agriculture and Biophysical Investigations.

‡ Office of Dry Land Agriculture in co-operation with the Office of Biophysical Investigations.

§ Office of Cereal Investigations in co-operation with the Office of Biophysical Investigations. See Tillage and rotation experiments at the Nephi Sub-station, Utah, United States Department of Agriculture, Bulletin 157, 1914.

not to direct evaporation, is supported by the fact that in other experiments at this station, spring-ploughed, uncultivated fallow on which the weed-growth was slight was practically as effective as cultivated fallow

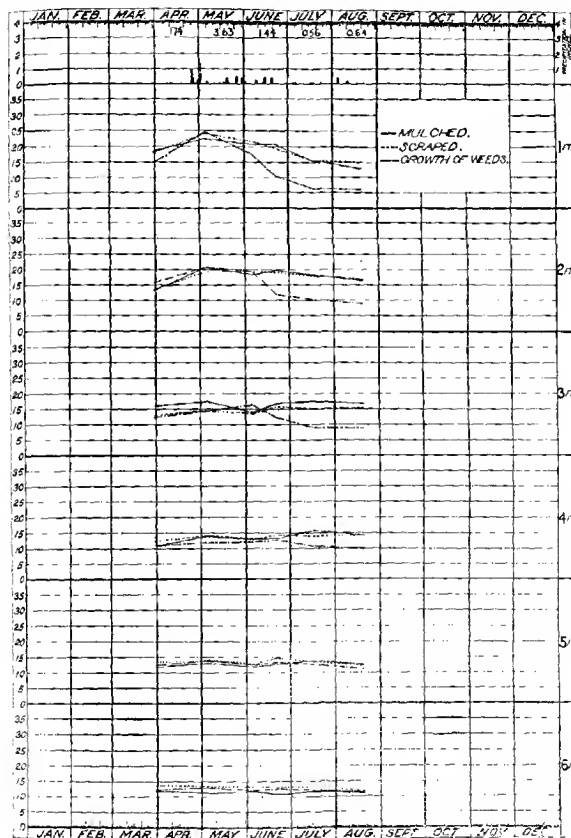


Fig. 3.—Loss of moisture from a mulched plot in comparison with a plot the surface of which has been scraped with a hoe to cut the weeds, and with a plot on which the weeds are allowed to grow. It will be seen that the mulched plot and the scraped plot differ little in effectiveness in conserving water, while the weeds reduce the moisture content to a depth of 3 feet.

in conserving moisture. The average moisture content (6 feet in depth) of the weedy *Nephi* plot was, at the time of the spring sampling, 0.8 per cent. below the cultivated plot; and at the time of the fall sampling,

4.5 per cent. below the cultivated plat. This loss in moisture during the summer is equivalent to 3.5 inches of rainfall stored in the soil. This amount of water is sufficient, according to the water-requirement

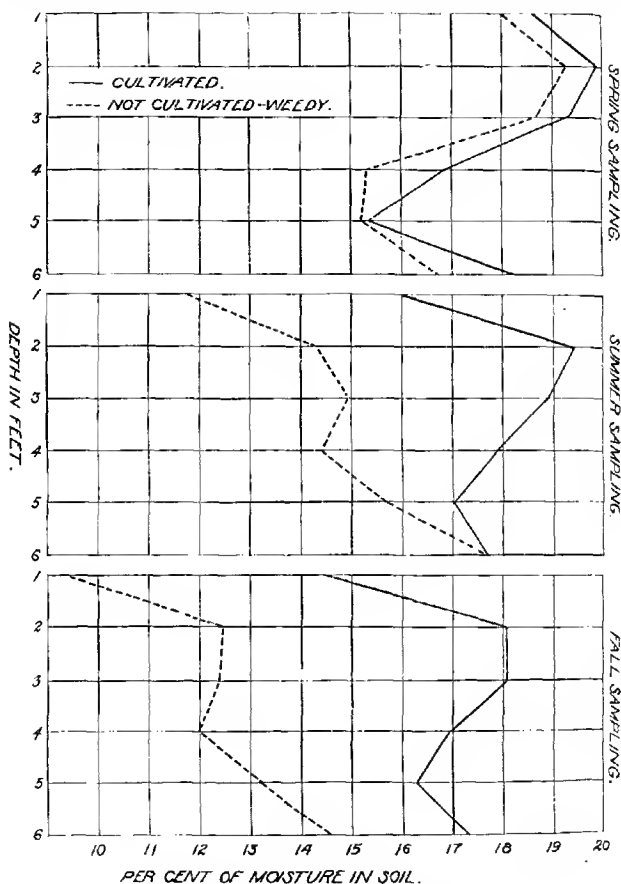


Fig. 4.—Loss of water from cultivated and weedy plats at Nephi, Utah, as the season advances.

measurements of Briggs and Shantz*, to produce 10 bushels of wheat per acre at Akron, Colorado, where the evaporation is the same as at Nephi. In 1911, the actual increase in yield of the cultivated plat

* Briggs, L. J., and Shantz, H. L. Relative water requirement of plants.—*Journal of Agricultural Research*, United States Department of Agriculture, 3, 1, 1914.

over the weedy plat was 11 bushels per acre. During the other years, the yield was reduced by winter-killing, so that the water supply was not the primary factor in determining production. Surely no more convincing proof is needed of the necessity of keeping fallow land free from weeds in regions where the moisture supply is of primary importance!

Growth-water.

It has long been known that a part of the soil moisture is held so tenaciously that it is not available for the growth of plants. Sachs, in 1859, appears to have been the first to recognise that the percentage of non-available moisture varies greatly with the type of soil. This is a matter of fundamental importance in the interpretation of soil-moisture observations, for the water unavailable for growth ranges from 1 per cent. or less in sand, to 30 per cent. or more in the heaviest types of clay.† Obviously, then, the percentage of water in the soil that is available for the growth of plants, or the "growth-water," as Fuller‡ has termed it, cannot be determined until this unavailable residue is known.

Always§ has used the hygroscopic co-efficient, *i.e.*, the percentage amount of water that a dry soil absorbs on exposure to a saturated atmosphere, to represent the unavailable portion. Briggs and Shantz|| have measured the moisture content at which plants undergo permanent wilting when growing in a limited soil mass, protected from surface evaporation. By permanent wilting is meant a condition from which the plants cannot recover when exposed to a saturated atmosphere.¶ The percentage of moisture remaining in the soil under such conditions has been termed the "wilting co-efficient" of that particular soil, and has been found to vary slightly with the kind of plant used as an indicator. The "wilting co-efficient" in connexion with a total moisture determination provides a means for calculating the "growth-water," the latter being the surplus above the wilting co-efficient. By the aid of such determinations it is possible to calculate the amount of stored growth-water—the bank balance. so to speak, in the water account, against which the crop may draw.

It is not necessary always to measure the wilting co-efficient directly, since it can be calculated from other physical properties of soils that can be more readily measured. Thus the moisture equivalent, hygroscopic co-efficient, and mechanical composition have all been shown to bear a linear relationship to the wilting co-efficient.** Of these indirect methods, that based on the moisture equivalent†† is the most rapid and

† Briggs, L. J., and Shantz, H. L. The wilting co-efficient for different plants and its indirect determination.—United States Department of Agriculture, Bureau of Plant Industry, Bulletin 230, 1912, pages 56-59.

‡ *Botanical Gazette*, 53, page 513, 1912.

§ *Journal of Agricultural Science*, 2, 1908, page 334.

|| *Op. cit.*

¶ As the plant approaches a wilted condition its transpiration is reduced. Furthermore, as soon as wilting occurs it is necessary to transfer the plant to a saturated atmosphere in order to determine whether the observed wilting is temporary or permanent. Consequently during the final stages of a wilting co-efficient determination the transpiration rate is greatly reduced.

** Briggs and Shantz. *Op. cit.*

†† Briggs and McLane. *Journ. Am. Soc. Agron.*, 2, 1910, page 138.

satisfactory. The latter represents the percentage of moisture remaining in the soil when brought into equilibrium with a centrifugal force 1,000 times that of gravity. The wilting co-efficient is approximately one-half the moisture equivalent.

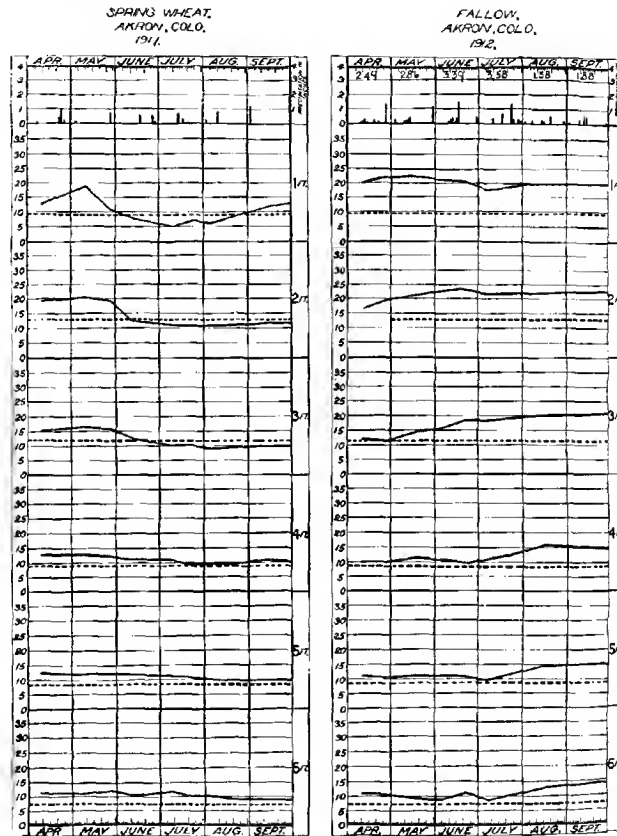


Fig. 5.—Moisture conditions in spring wheat and fallow plats at Akron, Colorado, to a depth of 6 feet. The dotted lines represent the wilting co-efficient for each foot section.

Where a small grain crop has extended its root system to a depth of 4 feet or more, the moisture content of the second and third feet is sometimes reduced below the wilting co-efficient. This is practically sure to occur if the crop is suffering for water, for plants are able to

reduce the moisture content far below the wilting co-efficient while in a wilted condition, or during the ripening process. But it appears also to take place while the crop is still growing, provided the root system is in contact with growth-water in some other part of the soil mass.*

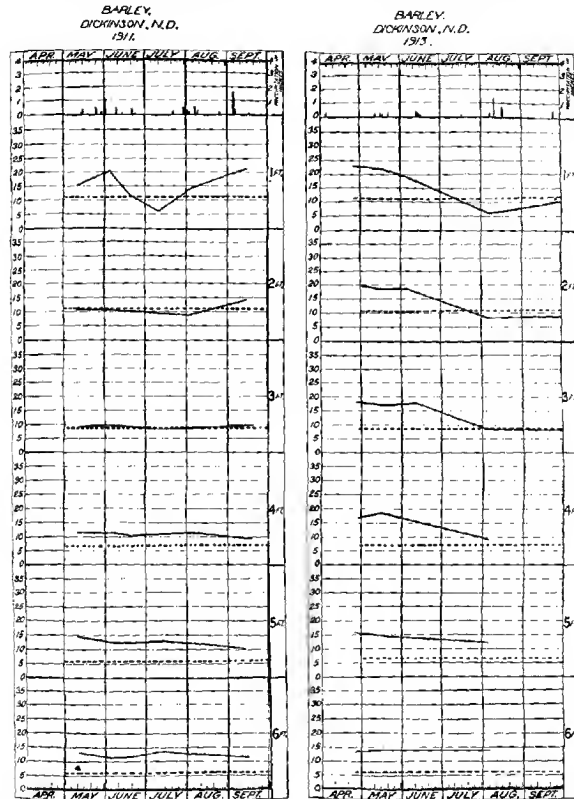


Fig. 6.—Moisture conditions in a barley plot at Dickinson, North Dakota. The dotted lines represent the wilting co-efficient for each foot section.

In other words, where the root system is already established, the crop is able to reduce the moisture content below the wilting co-efficient, and can use this to supplement the growth-water that it is drawing from lower levels. (See Fig. 5, 1911.) On the other hand, crop plants

* Briggs, L. J., and Shantz, H. L. Application of wilting co-efficient determinations to agronomic investigations. *Journ. Am. Soc. Agron.* 3, 1911, page 250.

show no tendency to send new roots into soil in which the moisture content is reduced to the wilting co-efficient. (See Fig. 6, 1911.)

An example of the application of the wilting co-efficient to the interpretation of moisture determinations is shown in the accompanying measurements by W. M. Osborne,† at Akron, Colorado (Fig. 5). The change in moisture during the season in each foot-section to a depth of 6 feet is shown graphically by the solid lines. The dotted lines represent the wilting co-efficient for each foot-section. The first chart (1911) represents the moisture conditions under a crop of spring wheat during a dry season, the crop being practically a failure. It will be seen that in the spring there was available moisture in small amounts to a depth of 6 feet, the greater part being in the upper 3 feet. The crop had removed the growth-water from the first foot by 1st June; from the second and third feet by 15th June; from the fourth foot by 15th July; while the fifth and sixth feet still contained a limited amount of growth-water at harvest time, although the moisture had been reduced in each case.

The second chart (1912) shows the moisture conditions in the same plat during the next summer while the land was in fallow. At the time the spring samples were taken, the moisture content of the surface foot of soil was practically up to the field-carrying capacity of this soil. With the advent of the seasonal rains, the surface foot began to deliver to the section below. It will be noted that the change in moisture content does not take place simultaneously through the soil mass, but is progressive from foot to foot, each section delivering water to the section below as it rises to its field-carrying capacity. When the moisture supply is below a certain percentage, dependent upon the soil in question, capillary adjustment in that soil is very slow. Plants, in order to avail themselves of all of the growth-water, must consequently develop a root system which permeates the soil mass from which water is being drawn. In other words, when the moisture supply is limited, the capillary distribution becomes so slow as to be effective only through very small distances. Plants having a coarse root system, such as maize, when used as indicator plants, might be expected to give a somewhat higher wilting co-efficient than plants with fine root-systems like the small grains, and this has been observed to be the case.‡

The first chart in Fig. 6 represents the moisture conditions, as measured by J. C. Thysell†, in a barley plat at Dickinson, North Dakota, during the dry season of 1911. This plat is normally seeded to barley each year. Inspection of the chart will show that at the beginning of the season the moisture content of the second and third feet was at the wilting co-efficient, to which it had been reduced by the preceding crop. A good supply of growth-water was present in the fourth, fifth, and sixth feet of the soil, but the roots were unable to penetrate the intervening dry layer, and the crop was a failure. In 1912 the crop was destroyed by hail, so that the plat was virtually in fallow during this season. The rainfall in 1912 was ample, and the soil was well supplied with water in the spring of 1913, as shown in the second part of the

† Office of Dry Land Agriculture in co-operation with the Office of Biophysical Investigations.

‡ Briggs and Shantz. *Op. cit.*

chart. During this year, a heavy crop of barley was grown, which was produced in part with water present in the soil in 1911, but unavailable to the 1911 crop because the intervening soil was reduced to the wilting co-efficient before the root system was established. It would be difficult to interpret these moisture conditions without the aid of the wilting co-efficient determinations, especially where the moisture retentivity of the soil and subsoil is not the same, as in the case of the Dickinson soils.

The growth-water content at seed time and harvest in two plats at Akron, Colorado, is shown graphically in Fig. 7, for six years. These

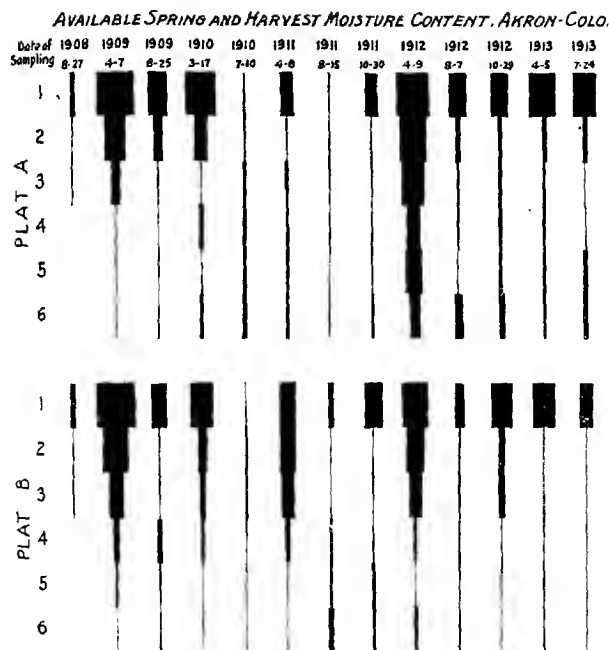


Fig. 7.—Growth-water at seed time and harvest in spring ploughed (A) and fall ploughed (B) plats continuously cropped to grain.

plats form part of the cultural experiments of the Office of Dry Land Agriculture, and are continuously cropped to spring wheat, A being spring-ploughed, and B fall-ploughed. The width of the shaded portion in each foot-section shows the amount of growth-water. It will be noted that the growth-water was in every instance practically exhausted at harvest time, with the exception of the surface foot, which, in some instances, had been moistened by rains near the harvest period. It also appears that at this station the time of ploughing has little influence on the soil moisture content.

Maintenance of the Fertility of the Dry Farm.

The maintenance of fertility under a system of continuous grain farming, such as is practised in many dry-farming sections, bids fair to become a more and more serious problem as the years advance. The period of cultivation of much of the dry-farm land has been so short as to afford no information on this point. In any event, it is hardly a problem that can be taken up with the man who breaks the virgin land. His first concern is for bread, and his chief desire is to draw upon the resources of his land to its fullest capacity. It is only after a marked decrease in production has occurred that he will listen to measures designed to maintain the fertility of the soil. Happily, grain farming, as practised on some of the oldest dry-farms in Utah, does not yet appear to have diminished the productiveness of the soil. This is doubtless due in part at least to the fact that the wheat has been cut with a header (or more recently with a combined harvester) which leaves most of the straw on the land. Stewart and Hirst* have found that the humus and nitrogen content of the surface soil of the wheat lands farmed for ten years or more, has not fallen below that of adjacent virgin soils. In an earlier investigation, Stewart† found that the oldest wheat lands in Utah, under cultivation for fourteen to forty-one years, either continuously or by summer-fallowing methods, had showed no loss in humus or nitrogen in the surface foot. The second foot of the cultivated soils showed, however, a slightly lower nitrogen content than the virgin land. The yield also appears to have been maintained.

A wanton waste of organic matter occurs in many dry-farming sections in the northern Great Plains, and in California. The stubble is burned to make the ploughing easier and to destroy weed seeds, and the straw stacks are burned in the field because they are in the path of the ploughs. As the ploughing season approaches, the horizon is often lighted at night in every direction by the flames of the burning stacks. Even where straw alone has been removed, grain farming in the Great Plains has resulted in a marked decrease in the nitrogen and humus of the soil. Alway‡ has shown that the cultivation of the loose soils of Nebraska has been accompanied by a marked reduction in nitrates, total organic matter, and humus. He attributes the greatest loss of these components to the washing or blowing away of the surface soil.

Snyder§ found that the loss of nitrogen from four Minnesota grain farms in ten years was from four to six times that removed by the crops. This loss he attributes to the rapid breaking up of the humus under cultivation. Where legumes were grown, crop-rotations practised, live-stock kept, and the farm manure used, the nitrogen content of the soil was maintained. This practice the dry-farmer of the Great Plains must eventually adopt, as far as his conditions will permit, if a permanent agriculture is to be assured in these sections. The American dry-farmer has much to learn from Australian practice in the use of stock, especially sheep, on the dry-farm.

* *Journ. Am. Soc. Agron.*, 6, 49, 1914.

† Utah Experiment Station, Bulletin, 109, 1910.

‡ Bulletin 111, Nebraska Experiment Station, 1909.

§ Bulletin 84, Minnesota Experiment Station, 1906.

The Water Requirement of Different Dry-farm Crops.

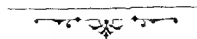
A word must be said in regard to the importance of considering the water requirement of crops grown on the dry-farm. Other things being equal, those crops which are most efficient in the use of water are obviously best adapted to dry-land conditions. The great success of millet, sorghum, and maize in American dry-farming is due in part at least to their remarkable efficiency in the use of water. The amount of water required for the production of a pound of dry matter of some strains of alfalfa is four times that required by millet, where the two crops are growing side by side. Different varieties of the same crop often exhibit wide differences in water requirement. The following figures represent the range in water requirement due to varietal differences as measured by Briggs and Shantz† in the Great Plains.

TABLE III.—VARIETAL RANGE IN THE WATER REQUIREMENT OF DIFFERENT CROPS.

Crop.	Pounds water required to produce one pound of dry matter of the	
	Most efficient variety.	Least efficient variety.
Millet	261 = 15	444 = 9
Proso	268 = 1	341 = 10
Sorghum	283 = 3	467 = 9
Maize	315 = 3	413 = 5
Wheat	473 = 8	559 = 4
Barley	502 = 4	578 = 13
Oats	559 = 8	622 = 9
Clover	789 = 9	805 = 5
Alfalfa	651 = 12	963 = 9

These wide crop and varietal differences in water requirement suggest great possibilities in the development of strains for dry-land conditions. In fact, the measurement of the water requirement affords a novel and promising method of attack in the breeding and selection of dry-land crops.

† *Journal of Agricultural Research*, United States Department of Agriculture, 3, 58 1914.



THE MAIZE-PRODUCING INDUSTRY IN VICTORIA.

By Temple A. J. Smith, Chief Field Officer.

(Continued from page 381.)

INTERCULTIVATION.

In twelve to fifteen days after planting, the maize should be above ground 6 or 7 inches, and at this stage the harrows should be run over the field across the rows; in this way the maximum amount of good will result with the minimum amount of damage. If the maize has grown to a greater height, and the harrows are liable to break the stems, this operation must be dispensed with. Later on, the cultivator should be run between the rows at intervals, or following any rainfall that cakes or crusts the surface, and cultivation should continue until the maize is 6 feet high. Shallow working at a depth of not more than 3 inches at first, and at a still less depth as the crop grows, until the last two cultivations are merely skimmers. The maize roots are very fine and numerous. They must have air, and breaking the surface of the soil admits air easily. Weeds are kept down in this way, and the rainfall readily admitted to the soil in the right places, the broken surface also prevents loss of moisture by evaporation, which can otherwise take place at the rate of 300 to 400 tons of water per acre in three to four dry weeks; such a loss might easily mean the difference between profit or loss on the crop. Nitrification is increased, and further phosphoric acid and potash supplies liberated. Tyne cultivators do more effective work at this stage than discs, letting the fine soil fall to the bottom and bringing the lumps to the top, the surface is thus more open. Hilling is not recommended, as generally more harm than good is done; only when the maize is falling badly should it be practised. Intercultivation is just as important on exactly the same lines for fodder maize as for grain, in order to get the highest food values and quantities.

SUCKERING, TOPPING, DETASSELING.

Suckering is rarely practised, though some maize varieties are bad in this respect, the effect of suckering on the yield does not, as a rule, compensate for the labour involved, and it is only where the suckers can be used as fodder for dairy cows or some other purpose that it will pay. When suckering, care should be taken not to injure the main plant; cutting with a heavy butcher's knife is the best plan.

Topping, except where fodder is required, is not advisable, the yield being affected. The greatest nutritive value in the green plant is in the upper portion as fodder, and only as fodder is it of value.

De-tasselling has proved a mistake, the yield being depreciated thereby.

SOWING CATCH CROPS.

The habit of sowing clovers, rye, vetches, &c., amongst the maize before harvesting is not generally adopted in Victoria, though in some cases it might be advantageous both from a fodder point of view, and

also as a useful rotation, for reasons previously given under "Rotation Cropping." A good start is often secured in this way for winter feed, the maize protecting the young grasses and crops throughout the autumn.

HARVESTING.

Maize is generally allowed to ripen well on the stalk and remain until May, June, or July, before picking the ears is attempted. Some varieties are, however, ready well before this period, and could, if required, be picked as early as March and April. There are several different methods in vogue, the most popular and probably the best being to pick the ear and husk it at the same time, the cobs being then bagged and taken to the crib or bin, where it is left to dry. The crop must be quite ripe before the husking can be done in the field. The cost of so harvesting is 6d. per 4-bushel bag of cobs.

It is claimed that a satisfactory machine is now in use for gathering and husking ears; it is, however, cumbersome, requiring six horses to pull, and is only effective where the maize stands up well, and the work is done on a large scale.

Where husking is done by hand, a short knife blade in a sheaf strapped across the palm of the hand is of great assistance in removing a refractory husk.

In some cases the ears are harvested with the husk on and carted to a shed, where later on the husk is removed. This is not always a safe practice, as the ears may contain too much moisture, and when thrown down in heaps mould is liable to occur, and damage the quality, colour, and germinating power of the grain.

For silage, the right stage to harvest maize is when the grain is just beginning to harden from the milk stage; at this time the crop has made its maximum growth. There is more sugar in the stalk, and the highest degree of food value has been reached. It is better to cut a little on the ripe side than too green, always bearing in mind that at least 70 per cent. of moisture is necessary for the successful making of silage. The addition of water sprinkled over the silage as it is put into the silo, if on the dry side, will be of advantage. The crop should be carted to the silo or stack as soon as cut, and at least a depth of 5 feet piled in and well tramped each day. The great secret in making silage is the exclusion of air, tight and close packing with pressure being the best means of obtaining this condition. All silage is better for being chaffed, as it lies closer and is more easily handled when required for feeding purposes; there is also less waste. Where stack silage is made of the whole stalk it is imperative that the stalks lie straight, lengthways in the stack, otherwise it will not pack well. A good dose of water on top of the silage when the stack is finished will hermetically seal the surface, after which weights can be put on in the shape of sand bags, rails, logs, or any convenient material.

Silage in the silo should be removed in layers from the top at the rate of from 12 inches to 24 inches per day; at a lesser rate the air will penetrate, and sour or mould the silage in the surface layers, slightly reducing its palatability. In stack silage, the weights can be removed from the end a few feet, and thrown back on the stack, and the silage cut in benches, with a hay knife, sharp steel spade, or axe.

About 40 lbs. of good silage is a daily ration for a cow, but to get full value as a food, it should be mixed with 5 to 10 lbs. of oaten hay or 2 lbs. of bran.

For sheep, $1\frac{1}{2}$ lbs. to $2\frac{1}{2}$ lbs. per day will be found sufficient to keep them alive, young growing sheep requiring more than the matured animals. For sheep especially, the addition of a few oats fed with the silage will make a good balance ration.

STOVER.

An immense waste of fodder takes place every year in the maize stalks, which should be turned to a profitable account by making them into stover, as is the case in the maize-growing districts in America, and in times of drought, such as are experienced in Victoria from time to time, large supplies of valuable fodder could be supplied in this way with considerable profit to growers.

There is roughly 20,000 acres of maize grown in Victoria, and taking the average yield of stalks at a low estimate, viz., 6 tons per acre, 120,000 tons of fodder could be obtained from such a source.

The feeding value of stover is nearly equal to that of oaten straw, as is shown hereunder, *vide* Thomas Shaw, on Feeding Farm Animals.

	Total Dry Matter.	Protein.	Carbo-hydrates.	Fat.	Fuel Value.
Oat straw ..	90.8	1.20	38.64	0.76	77.310
Stover ..	59.5	1.98	33.16	0.57	67.766

This is admittedly low, but in times of drought and scarcity of fodder, would be worth from £2 to £4 per ton, and might be the means of saving a large number of stock to the State and the individual. The cost of making stover should not exceed 15s. per ton, and, at the same time, the stalks of the maize being cleaned up, a process which, under present systems in Victoria, is a matter of expense to the grower. Harvesters are used in America to cut the crop when ripe, stalk, cob, and husk together; the whole is then stooked in open stooks to allow free circulation of air to allow the ears to dry without danger of mildew, and later the ears are passed through a machine which husks and threshes the grain.

The stalks are then passed through a shredder, and the material so obtained stored away for use. The object of cutting the whole crop is to save the greatest possible feed value in the stalks, which, if left to dry in the field, would deteriorate more or less.

In feeding maize stover to stock, some better quality food, such as bran, lucerne, oats, &c., should be mixed with the stover, which, by itself, is only equal to straw chaff.

(To be continued.)

THE WALNUT.

(Continued from page 473.)

C. F. Cole, Orchard Supervisor.

PROPAGATION—continued.

NURSERY GRAFTING.

The successful propagation of any selected variety of the walnut either by grafting or budding is not so easily accomplished as ordinary fruits, such as the apple or pear.

The operation of grafting or budding requires to be carefully performed by a skilled and practised hand. Even when performed by the most skilled and under the most favorable conditions, the average percentage of successes would be considered unsatisfactory compared with the results from the same class of work upon the commoner fruits of commerce.

The propagation of this nut is carried out by grafting or budding at the proper seasons of the year, although grafting is the most favoured, budding may be practised in conjunction with it. Grafting has a decided advantage over budding, as, with the walnut, it is easier and more quickly performed, and usually greater success results. There are many methods of grafting; whichever is adopted needs skill and practice.

The following method described and recommended for nursery work by the writer is one that has proved to be most successful, both with the walnut and other species of fruits difficult to propagate. It is practically a combination of the cleft and whip grafting methods. The advantage is that three surfaces upon the cut scion come in contact with equal parts of the cambium, or inner bark, upon the stub of the seedling root stock. (Plates 34b, 35c.)

The time to commence grafting operations is in early spring before the seedling trees commence growth, finishing by the time they are coming into leaf.

Grafting wood for scion purposes of any desired variety should be chosen from trees of productive, healthy, and vigorous habit. Well-matured wood of the previous season's growth with little pith and full buds spaced not too far apart should be selected. Two-year-old wood may be used if it has good buds, and should be cut from the tree during the winter and after growth has become dormant. Scions cut from trees whilst the sap is active should not be used. The grafting wood from the tree, if it is to retain its moisture and vitality, must be either buried in moist sand, sawdust, sphagnum moss, or heeled in in a cool sheltered place, shed or cellar. Care must be exercised in seeing that the material is moist and kept so; excessively wet or dry conditions are injurious to the walnut scion. When grafting, unhealthy scions and dark wood should be discarded. Upon the removal of the grafting wood from the sand, rinse carefully in clean soft cold water to remove any grit that might tend to dull the keen edge of the grafting knife, which should be kept always sharp and clean.

When cutting the scions into lengths just before grafting there should be not less than two buds upon each scion, one at each end, the lower bud should be about $1\frac{1}{2}$ inches up from the lower end of the scion. Plate 34B X indicates position of lower bud. Before commencing, the operator should provide himself with a small box or other suitable receptacle for holding the scions of different sizes, a whetstone and leather strop, a pair of secateurs, pruning saw, brush, raffia or some soft twine for binding purposes, a heating stove for keeping the grafting wax melted. This stove can be made from a small oil drum,

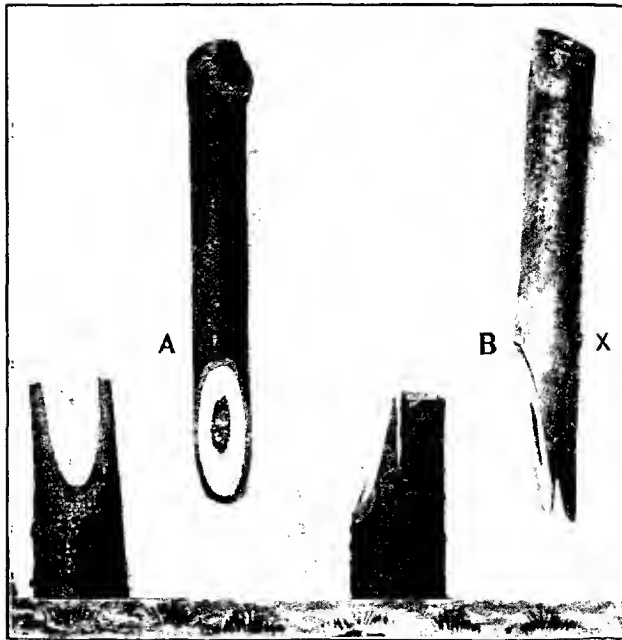


Plate 34.—Grafting Method.

A. Front view of cut stub and scion.

B. Side view. X indicates position of lower bud.

cutting out a piece near the bottom, and making a few holes around the lower portion similar to one used by a plumber for heating his soldering irons.

Grafting wax is prepared as follows—3 lbs. of pulverized resin, 1 lb. of beeswax, $\frac{1}{2}$ lb. of lard, tallow, or fat containing no salt, $\frac{1}{2}$ pint linseed oil, boiled or raw, may be substituted for lard, fat, &c.

Another formula is to use equal quantities of resin and paraffin wax. When making grafting wax place the oil, wax, and other ingredients

in first, and then add the resin, stirring whilst melting. The consistency of the wax can be regulated by adding more resin if not hard enough, and more fatty substances if softening is required. A harder wax is necessary in hot than in mild or cold weather.

The first work necessary when starting nursery grafting is to carefully remove the soil from about the seedlings to be operated upon, exposing the butt down to the crown of the root. If the soil has been kept well stirred this can be easily accomplished. If the soil is hard around the seedlings it may be necessary to apply water some hours before attempting to remove the soil. The seedling tree should be cut off with a sharp pair of secateurs or saw, close to the ground, leaving sufficient of the butt to operate upon. Before using the knife upon the stub it is advisable to rub off any particles of dirt. The operator should then pare away and level off the top of the stub, and upon one side make a clean upward sloping cut, not cutting so far in as to remove too much wood. Now, with the blade of the knife, split the stub down on this side for about 1 inch (plate 34a), splitting the stub down through the pith should be avoided if possible. Some grafters make the split first, and the upward sloping cut last, whichever way this part of the work is performed the operator should take care to see that the surface of the sloping cut is level, and not left too thick at the upper end (plate 34b), otherwise the scion, when inserted, may not fit close and neatly. The scion, when placed in position, should fit tight, the cambium or inner bark coming in contact with the three different surfaces (plate 35c).

Having prepared the stub, a scion should be selected, not larger, but may be smaller, than the stub. A clean smooth sloping cut should be made at the bottom end of the scion and directly opposite to the bud. The blade of the knife is then inserted between the bark and the pith at the lower end on the longest side of the scion, a cut being made upwards nearly to the bud. This upward slit or cut, when properly made, should have only a thin strip of the wood with the bark (plate 34b). Then the cut scion is inserted upon the prepared stub, as shown in plate 35c. The stock and scion should be firmly bound with raffia or soft twine to hold them firmly together. The union should then be thoroughly waxed over, and also the cut upon the upper end of the scion (plate 35d). It is essential that no part of the cut stock and scion is left unwaxed. Having performed this work, the last operation is to replace the soil, covering the scion and stub well. This covering with soil must be carefully performed, so as not to displace or break out the scion. The soil should be worked up fine and friable before the moulding operations take place. If grafting a large number of trees, the operator should have an assistant to remove the soil, cut off the seedlings, and do the waxing and tying, which must be done without delay after cutting to avoid drying out. If the grafting has been successful it will not be long before the scions start to shoot. Robber sprouts from the stub of the seedling stock, will also appear, and these must be carefully removed as soon as the growth from the scion is well started. At this period attention must be paid to the binding, the raffia or twine should be cut through so as to allow the gradual expansion of the scion and stock, thus preventing cutting in and causing injury. This should be accomplished by removing with

the point of a knife a narrow strip of the wax at the back of the stub, exposing the binding for cutting. Under no conditions should the binding and wax be removed. After cutting the binding replace the soil so as to cover again the union of stock and scion. As soon as the shoots start to grow rapidly it is necessary to stake and tie them, using stout stakes about 6 feet high the tying being done carefully and not too tightly, using soft twine or rope. As the walnut makes rapid growth, attention must be paid to the tying to see that it is not cutting

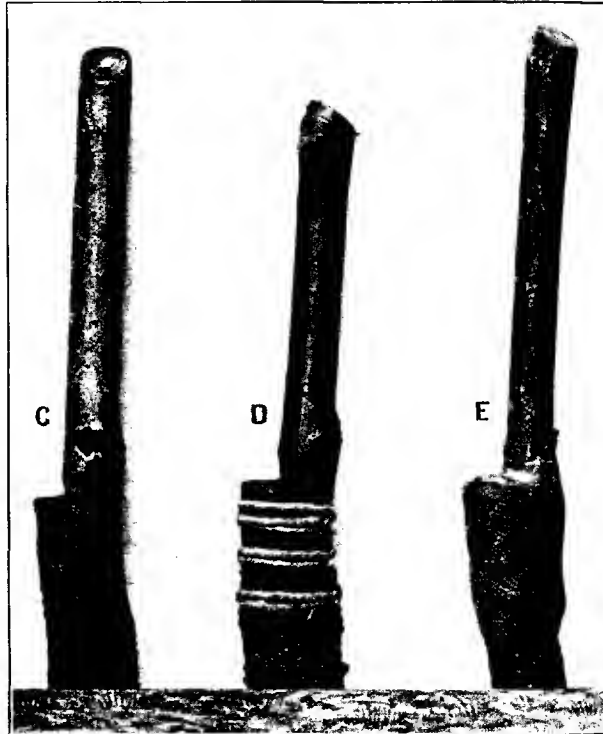


Plate 35.—Grafting Method.

C. Inserted scion. D. Tied. E. Waxed.

in and causing injury to the developing shoot. If the scion sends up more than one shoot, the stronger should be tied to the stake and the other carefully removed. If the lower bud upon the scion makes the stronger shoot, do not attempt to cut the scion off close to the lower shoot to be left, remove the top shoot only by cutting away close to the top of the scion. The useless piece of the scion can be cut away at any future time.

If the graft does not take, one of the strong shoots sprouting from the stub of the seedling should be allowed to grow, and may be budded or left for grafting upon the following spring.

If the union between the scion and stock is poorly callused and the growth of the scion is weakly, the young grafted tree should be discarded, nothing but strong healthy stocks should be grafted, and only grafted trees that are strong and vigorous in the nursery row planted out. With care, and grown under favorable conditions, the majority of the grafts should be large enough to transplant the following winter in orchard form.

TOP GRAFTING.

Seedling trees that have been planted out in orchard form with the object of top working them over with selected varieties may either be grafted upon the main stem, if not more than 3 to 4 inches in diameter, cut off 2 to 5 feet from the ground level, or else upon the branches, reducing them back close to the main forks of the tree. It is not advisable to cut off and graft upon any very large limbs. Not alone is the scion less certain to take than when inserted upon a smaller one, but by exposing a large surface the wood is very susceptible to decay. The time for cutting off the top or limbs for head grafting is just before the trees start to send out new growth in the spring. Ground grafting is performed at the same time. When sawing off the top or boughs, care must be taken not to split, or tear the bark down the stub.

In America the usual method of top grafting the walnut is the ordinary cleft graft commonly practised in Victoria upon many kinds of fruits. When performing the work it is usual to split the stub through the middle, insert the wedge in the cleft, trim the split edges of the bark and cambium with a sharp knife, cut the scion to a smooth bevel upon either side, and insert the scion carefully, seeing that a good fit is made and the cambium layer of the stub and scion brought into direct contact. A somewhat different method of cleft grafting practised at times upon large fruit trees here is favoured by some in America when the stubs are more than 2 inches in diameter. Instead of making one cleft across the middle of the stub, two or more are made at uniform distances apart near the edge. In making the splits, the splitting knife is held in a horizontal position over the place where the cleft is desired, and driven to a depth of about half-an-inch. It is then tilted up in a slanting position and driven down to a depth of $1\frac{1}{2}$ to 2 inches, first at one end of the cut and then the other—the rough edges of the bark are smoothed with a sharp knife, and the cleft held open to receive the scions. The scions are prepared by bevelling off one end into a wedge shape, cutting clean through the pith on one side, and then down to the pith upon the other. The back side of the wedge, that which is placed towards the outside of the stub, is made wider than the side which goes towards the interior of the stub.

There should be not less than two buds upon the scions, one at each end, as already depicted in plates 34 and 35.

In cleft grafting it is advisable to slant the point of the scion a little towards the center of the stub, so that the upper end of the scion

points outwards somewhat, thus making certain that the cambium will meet at one point. By adopting this latter method of cleft grafting more scions can be inserted which, when grafting the walnut, is an important factor, because the more that take upon a stub the quicker will the cut surface heal over, even if it is necessary to cut off some of the growths the following year. After inserting the scions, bind with soft twine several times around the stub. As soon as this part of the work is finished, paint with grafting wax the whole of the surface of the stub and the clefts holding the scions. This part of the work is most important, and no places should be left unwaxed, however small, to allow the air or moisture to penetrate, for if this occurs the scion is certain to fail. It is also necessary to go over the stub regularly and renew the painting with grafting wax until the scions are thoroughly united. The whole of the scion must not be waxed, only that portion near and inserted in the cleft, and the cut top of the scion. The heading back of the trees for top grafting will result in numerous shoots sprouting out upon the stubs; these must be removed, and not allowed to smother the scions. If no scions have taken upon any one stub a shoot or two should be left upon each stub, allowing the tree to make foliage and carry on its normal functions. As soon as the scions begin to sprout it will be necessary to support them to prevent them becoming top heavy and broken out by the wind. Where the scions are inserted upon the trunks, tying to a stout stake will meet the case. The method adopted in America when branch grafting is practised is to nail 6-foot laths to the stubs into which the scions were inserted, and tie the sprouts loosely and firmly to these laths, removing the laths the following year if not required any longer. As a preventive against the trunk and branches getting sunburnt after grafting the Americans paint with a thick, heavy whitewash.

At the end of the first season's growth the trees should be gone over and all superfluous shoots cut out, the dead ends of the stubs cut off and carefully waxed over, and any shoots that are left removed, if not required for future grafting purposes.

The binding around the end of the stub should receive attention so that injury will not be done to the expanding wood of the scion and stub.

BUDDING.

The operation of budding the walnut is more difficult than that of ordinary fruit trees; yet considerable success has been attained, but results are somewhat uncertain even at the best. The usual method is called the annular budding. (Plate 36EF.)

The results of experiments carried out in America the most favoured form of budding is a partial ring or flute bud extending only part of the way round the stem instead of the whole way, as in the annular method. In America, this flute budding is performed in the nursery row, upon new sprouts from one year old seedling stocks upon which the grafts had failed, or seedlings which had been too small to graft during the winter; also upon shoots from the stubs of top-grafted trees where the grafts had failed. The work is performed at two seasons of the year, spring and the autumn. For spring budding the buds are taken from dormant wood cut during the previous winter at the same

time as the scions for grafting. If properly stored in a cool place with neither too much nor too little moisture, the scions will begin to callus at the ends, and the buds can be readily removed. In Victoria, from October to December would be the proper time to carry out the work. For autumn budding the buds are selected from the oldest wood of the current season's growth, cutting off the leaf stalks just beyond the buds about two weeks previous to budding. The leaf stalks drop off cleanly in a few days, leaving the buds ready for use. If the leaves

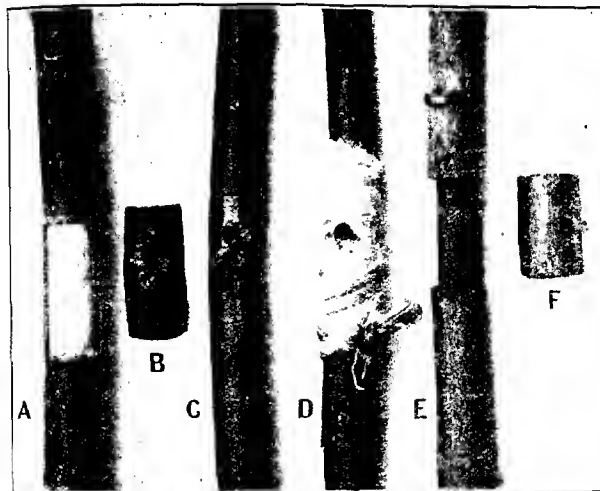


Plate 36.—Budding Methods.

A. B. C. D. Flute method. E. F. Annular method.

- A. Shoot ready to receive the bud.
- B. Cut bud ready for placing in position.
- C. Bud placed in position on the shoot.
- D. Bud tied with waxed strip of calico.
- E. Annular method, shoot cut ready for bud.
- F. Cut bud ready for placing in position.

are cut too soon the buds are apt to start into growth whilst on the parent tree. The time for autumn budding in Victoria is the month of March. The most favoured size of bud having a portion of bark attached is about $\frac{1}{4}$ inch to $\frac{3}{4}$ inch wide, and $\frac{1}{4}$ inch long. The former dimensions is that measured around the stem and the latter the vertical distance. When budding, the operator must use judgment in selecting seedling stocks or sprouts of such a size that the strip of bark bearing the bud will be of the right size, and not extend more than half way round the stock or sprout to be operated upon (plate 36 A and C). For annular (ring) or flute budding, a double-bladed knife is the most suitable. By fixing two knife blades of equal size upon a wooden handle $\frac{3}{4}$ inch

apart the operator will have a very useful knife for cutting and placing the buds in position. The buds may be put in just above ground level, 6 inches high, or where the stock has the proper size, so long as space is left for further attempts if the first bud is not successful.

When stripping off the bud after cutting, the core of wood inside the bud should remain in place without any difficulty; with good buds it is simply necessary to strip off the bark without attempting to include any of the wood. The most important factor in walnut budding seems to be rapidity in cutting and placing the bud in position, and binding, because of the tendency of the freshly-exposed walnut tissue to oxidize and turn black. If this once happens the tissue is sure to die, and no union between the stock will take place.

In budding walnuts particular skill and dexterity is necessary, in order that the fresh surfaces or cambium of the bud and stock may be exposed as little as possible to the air during the operation. A close fit is essential, and the inner surface of the bark should come into close contact with the whole exposed surface of the cut in the stock.

This is where the value of a double-bladed knife comes in, as no time is lost measuring the cut bud on the stock to get it the same size. The bark upon the stock should be removed first. If there is any delay after cutting the bud an American authority advises putting it in the mouth until ready to place upon the stock, and that there should not be the slightest delay at any stage of the operation. As soon as the bud is placed in position it should be tied with waxed calico cut into suitable length and width (plate 36b). With spring or summer budding this binding should be removed about fourteen to 21 days later, with autumn budding six or seven weeks later. Autumn buds remain dormant over the winter. The spring or summer buds should be forced into growth by reducing back the seedling stock or sprout about one-half after the binding is removed. After the bud has started into growth the stock should be cut back close to the bud, and the cut waxed over. With autumn buds the stocks should be cut off close to the buds when they start to sprout. Staking and care of the buds is the same as with grafts, and already described under heading of "Grafting."

(To be continued.)

A SUBSCRIBER to the *New Zealand Journal of Agriculture* writes—
"A man is a fool to cart out green stuff to his cows when he can have silage. I used to feed green crops, cutting the material every day and carting it to the cows. Now I put all my green stuff into a silo—which takes only a few days—and I have a continuous supply of good feed without having to go out every day in all weathers to cut it. The silage saves the daily labour, while the land is unlocked and can be used for grazing or for growing some other crop.

WOOL CLASSING.

The following are extracts from a paper on "Wool Classing" read by Mr. Digby B. Grist, before the National Sheep-breeders' Association, at the Nottingham Conference, 1915:—

The title of this paper may be misleading to the ordinary farmer, as many farmers do not discriminate between "classing" and "sorting," and often the word "sorting" is used where only classing is meant. So let me say right away that classing is the first process to be applied to the fleece, and is a work that any farmer, shepherd, or man of ordinary intelligence can do. Sorting, however, is a trade that no one can attempt unless he has served his time to a wool stapler, wool merchant, or manufacturer who buys his own wool and sorts it for the different kinds of cloth he makes. To further define these two processes, I would say *classing fleeces* merely means keeping the coarse from the fine, the long from the short, the dirty from the clean, and the heavy from the light. These four simple classings speak for themselves. Anybody with ordinary observation can decide whether a fleece is fine or coarse, short or long, light in condition or heavy. The condition of a fleece is determined by the amount of natural grease yolk and earthy matter it contains. If deficient in these respects it will be dry and light. If these four simple points were borne in mind by the farmer when shearing he would see at a glance, by throwing the fleece on a table or bench, which class it belonged to, and at the same time he would also be able to break off any hairy or dirty trimmings which may be adhering to the fleece. It is of the utmost importance to keep the *hairy leg portions* out of the fleece. These only amount to a few ounces, and do incalculable damage to the whole fleece, where they are treated as some farmers treat them, namely, rolled in a ball and included in the fleece. When shearing they are no trouble to take off and keep separate.

With regard to these trimmings, though it may not be generally known, the very fact of these few ounces of kempy wool being included in the fleece brings down the value of the whole, whereas if kept out a greater price is given for the bulk, and the trimmings, if sold separately, command a good market, as there are merchants who only deal in this inferior wool.

The processes I have enumerated constitute classing, and any farmer who takes the trouble to grasp the simplicity of it will readily see that it takes no longer to do up wool in this way than in the way he has been accustomed to, especially as there is no need to continue the old-fashioned way of *winding* the fleece or of tying it with string. All that is required is that the fleeces should be neatly rolled up, with one end tucked in to keep it intact.

Wool sorting is another process altogether. It is the breaking up of the fleece into many sorts to suit the manufacturer, which subject *need not be touched upon here.*

The advantages of classing wool were early recognised by Australian pioneers, and in the very early days of this Colony it was discovered that those who paid the most attention to this very necessary process obtained better average prices for their wool. The get-up of wool in

Australia has passed through several evolutions, the original wool-growers following the custom of English farmers in cold water washing the sheep. All wool that came from the Antipodes in the early days was treated in this way, and in the London catalogues the plain word "combing" was used to designate this class, all others having a prefix such as "greasy combing," "scoured combing," &c.

The extension of the sheep-growing industry from the coast and well-watered districts to the dry plains and pastures of the interior created difficulties, and at many stations it was found that sufficient water did not exist to wash the sheep thoroughly, so an experiment was tried in sending the wool to Europe in the grease. Manufacturers soon adapted themselves to the altered conditions, and eventually preferred the greasy wool to the washed, as it enabled them to treat the fleeces from the commencement and obtain better results by the greater or lesser quantity of grease left in the staple. The change was also agreeable to the grower, as it saved working the sheep at the cold water runs, and sheep can never be worked in large quantities without loss, and at the same time saved labour—a most important matter in a new Colony where men are scarce.

It was natural when all parties were in agreement that the days of washing wool were numbered, and at the present time out of the million and a half or two million bales that came from Australia only a few hundred bales of an exceptional fine breed of Merino, come to London in a washed state. It is true this merino wool realizes extraordinary prices—up to 4s. or 5s. per lb.—but the sheep are small, as a rule, due to the climate being cold, and they do not pay like the larger framed and heavier fleeced animals of warmer districts. A good deal of wool is scoured on stations long distances away from railroads to save expense in carting, but when practical it is always sent in its natural condition.

The system of classing has been carried to great lengths on the larger holdings in Australia, where from 100,000 to 200,000 sheep are shorn, classers know their work, and it must be clearly understood that in large flocks wool cannot be overclassified, as both here and on the continent manufacturers specialize in certain qualities, and the nearer they can buy wool to the quality they want the more they will give for it. It may be better explained by stating that some buyers only use Lincoln and Leicester wools, while others confine their operations entirely to cross-bred sorts, others to merinoes. Wether and ewe wool have also their separate admirers, so it can be easily understood that when all kinds are sold to a dealer in bulk unclassified he gives an average price and by classing the fleeces obtains the profit that might go to the grower, who could easily do this for himself.

The question of skirting is also a most important one, and the system that prevails to a large extent among lamb-raising flocks of rolling all skirts and ends in the fleeces is antiquated and pernicious, as it means the buyer has to estimate the quantity of inferior wool which he cannot see, and this estimate is seldom on the wrong side, and must tell very much against the interest of the seller in the long run.

The colonial markets are visited by buyers from all parts of the world, some to buy greasy wool, some to buy scoured, some to buy fine wools, and some to buy coarse, and some who confine their purchases exclusively to pieces and locks, and surely this is the best place to offer

your produce, and it is worth while to offer it in a condition to meet the demands of the market. It is a market where the man who takes the greatest care in the breeding of his sheep and the get-up of his wool gets the highest prices, and where competition instils into growers the spirit of emulation which is so necessary in obtaining the best results.

Buyers from all over the world congregate at the great wool sales held in leading cities. Wool is sold from New South Wales, Tasmania, Queensland, Victoria, West and South Australia, and New Zealand. The largest buyers from all parts of the world compete for its purchase, because they have the best opportunities of getting the kind of wool they want, and in the quantities in which they want it, and without having at the same time to buy what they do not want.

VINEGAR FROM WATER MELONS.

A New Mexico man has discovered a new use for the water melon. Reports from that State indicate that J. B. Page, of Deming, has built a mill at Myndus, in the Mimbres Valley of New Mexico, by which he will grind water melons into pulp and convert the juice into vinegar.

The first lot of melons were turned into the grind in September. The mill is supplied from 300 acres of melons. It is 118 by 80 feet, with a boiler-house 30 by 20 feet adjoining. The two boilers are 125 h.p. each, and the engine 125 h.p. The mill employs 20 men, and will manufacture 300,000 gals. of vinegar this season. The mill will also manufacture by-products, as table oils, pickles, preserves, syrups, and stock foods.—[Extract from *Pure Products*, May, 1915.]

RESULTS OF TESTS OF IMPORTED VARIETIES OF PEAS AND BARLEYS.

Last season, the Department of Agriculture secured, from the United States Bureau of Plant Industry, in exchange for certain varieties of wheat, a number of varieties of Pease and Barleys.

These were sown at the Central Research Farm, Werribee, in 1914, and, though the seasonal conditions were most unfavorable, the results obtained from some of the varieties were very satisfactory.

Only small quantities of seed of each were available, consequently the seed had necessarily to be sown in small plots. In order to make the trials as even as possible, the varieties were sown in single rows, 5 chains long, and certain standard Victorian varieties were sown alongside for purposes of comparison. The plots received one watering in August.

The attached tables, prepared by Field Officer G. S. Gordon, Central Research Farm, Werribee, give the results of the tests with Barley and Pease.

TABLE I.
SHOWING SUMMARY OF TESTS OF LOCAL AND IMPORTED VARIETIES OF
BARLEYS AT CENTRAL RESEARCH FARM, WERRIBEE.
SEASON 1914.

Variety.	Seed from	Sown.	Up.	Germination period.	In Ear.	Ripe.	Bulk Yield.	Grain Yield.	Ratio of Grain to Straw	Estimated Yield per acre.
		1914.	1914.	days.	1914.	1914.	lbs.	lbs.		Bush lbs.
Manchurian	U.S.A.	June 10	June 21	11	Oct. 1	Nov. 10	33	14	1:1.3	60.38
Odessa	"	" 10	" 22	12	" 7	" 20	23	8	1:1.2	34.36
Californian	"	" 10	" 23	13	" 7	" 20	23½	14½	1:1.0	61.42
Feed	"	" 10	" 23	13	" 10	" 20	28	8	1:2.25	34.36
Gatani	"	" 10	" 23	13	" 12	" 20	30	11	1:1.7	47.37
Primus	"	" 10	" 21	11	" 7	" 19	24	12	1:1.0	52.4
Hanchen	"	" 10	" 22	12	" 10	" 20	23	10	1:1.3	43.20
Princess	"	" 10	" 22	12	" 10	" 20	23	10	1:1.3	43.20
Golden Grain	Vict.	June 10	June 23	13	Oct. 13	Nov. 21	122	34	1:2.5	24.24
Gisborne	"	" 10	" 23	13	" 19	" 20	133½	52½	1:1.2	37.40
Kinver	"	" 11	" 24	13	" 20	" 21	122½	46	1:1.0	33.6
Gallinorpe	"	" 11	" 24	13	" 18	" 21	130	51	1:1.5	36.36
Archer	"	" 11	" 24	13	" 19	" 20	118	41	1:1.2	29.26
Prior	"	" 11	" 24	13	" 6	" 20	108½	43½	1:1.3	32.28
Roseworthy	"	" 11	" 24	13	" 6	" 20	141	63	1:1.2	45.18
Oregon	"	" 11	" 24	13	" 6	" 20	144	60	1:1.4	43.10
Square Head	"	" 14	" 24	13	" 7	" 21	155½	61½	1:1.5	44.14
Short Head	"	" 11	" 23	14	" 6	" 21	97	35	1:1.3	25.19
Skiless	"	" 11	" 24	13	" 6	" 21	135½	63½	1:1.1	45.36
Cape	"	" 13	" 26	13	" 6	" 21	135½	63½	1:1.1	45.36

TABLE II.
RESULTS.—TESTS OF LOCAL AND IMPORTED PEAS.
SEASON 1914.

Plot.	Variety.	Origin of Seed.	Date of Sowing.	Date of Germination.	Date of Flowering.	Date of Podding.	Date of Ripening.	Colour of Flowers.	Estimated Yield per acre.
1	Dun ..	Vict.	1914. June 10	1914. June 23	1914. Sept. 30	1914. Oct. 12	1914. Nov. 16	Purple	bush lbs. 10 9½
2	Partridge ..	"	" 10	" 21	Oct. 12	" 22	" 23	Red	6 6
3	Tasmanian Blue	"	" 10	" 24	Sept. 24	" 9	" 23	White	11 22
4	Black-eyed Susan	"	" 10	" 23	" 30	" 14	" 23	"	9 47
5	White ..	"	" 10	" 23	" 23	" 23	" 23	"	No seed.
6	Golden Vine	U.S.A.	" 9	" 24	Sept. 22	Oct. 12	Nov. 3	White	8 40
7	Amaroti ..	"	" 9	" 23	" 21	" 13	" 3	Red	7 15
8	Early Britain ..	"	" 9	" 24	" 17	" 7	" 4	Red ..	8 19
9	Scotch Beauty ..	"	" 9	" 24	Nov. 6	" ..	" ..	"	No seed.
10	Scotch Blue ..	"	" 9	" 23	" 6	" ..	" ..	"	"
11	Admiral ..	"	" 9	" 24	Sept. 18	Oct. 6	Nov. 1	Lilac ..	10 5
12	Bangalla ..	"	" 9	" 24	" 17	" 4	Oct. 28	Purple	7 26
13	Carleton ..	"	" 9	" 24	Oct. 14	" 30	Nov. 23	White	4 49
14	Kaiser ..	"	" 9	" 23	Nov. 6	" ..	Nov. 23	Purple	No seed.
15	French Grey ..	"	" 9	" 24	Oct. 12	Oct. 28	Nov. 23	Red	5 16
16	Canada Field ..	"	" 25	" ..	" ..	" ..	" ..	White	3 20

THE GREY MOULD OR BOTRYTIS DISEASE OF CITRUS TREES.

By C. C. Brittlebank, Government Vegetable Pathologist.

HISTORY OF THE DISEASE.

The first record of this disease tabulated in this office was received from the editor of the *Garden and Field*, South Australia, as long ago as September, 1900. Further specimens were not received until September, 1911, and again in September, 1912-13, when many came to hand and the disease appeared to be making headway among our citrus trees, when it was apparently checked by the protracted drought through which the State has just passed.

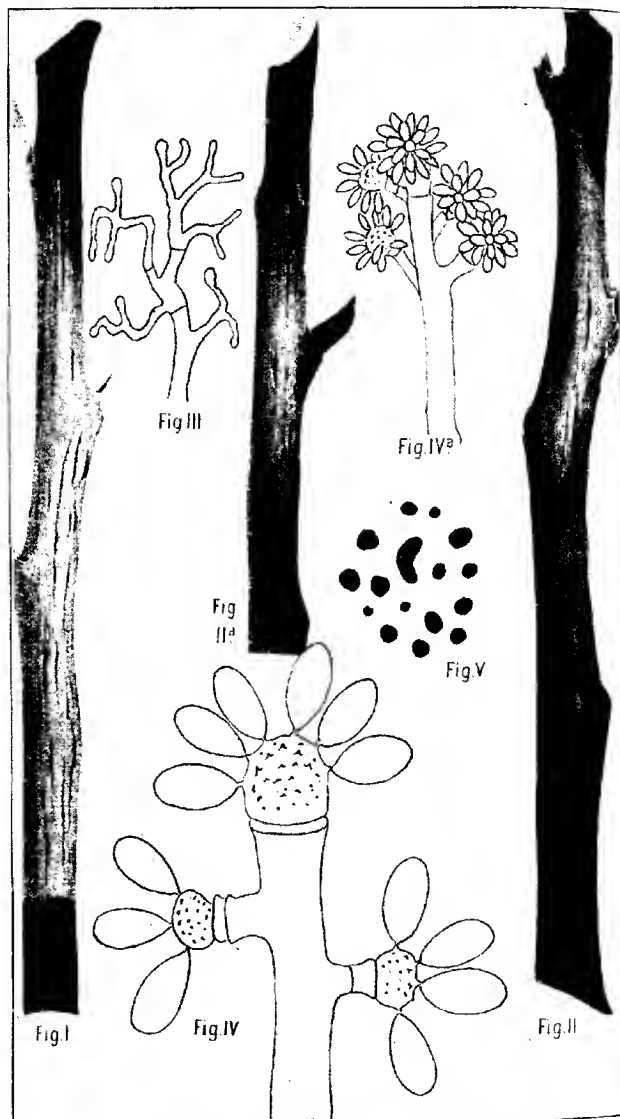
DISTRIBUTION OF THE DISEASE.

Citrus trees have come to hand affected with *Botrytis* from such widely separated localities as Mildura, Coluna, Bendigo, Yarrawonga, and also from several places in the north-eastern and south-western portions of the State. Judging from the above wide area it may be safely said that the disease occurs wherever citrus trees are grown.

GENERAL FEATURES OF AFFECTED TREES.

During 1912 two young lemon trees were forwarded for examination, the grower stating that they were two of many affected in a similar manner. These trees had a stem diameter of $1\frac{1}{2}$ inches and $1\frac{3}{4}$ inches respectively; they were well grown with fine strong roots, nicely formed heads, and to all appearances had been well cultivated. At a point about 9 inches above the bud, there was in each tree, a diseased area extending up and completely surrounding the stem for a distance of slightly over 6 inches. The diseased areas were slightly depressed, of a yellowish buff colour, the sunken surface being slightly glazed—the junction of the disease with a seemingly healthy bark both above and below being very sharply defined (Fig. 1 shows small branch of tree). Although examined with great care not the least trace of fungus could be observed on the discoloured portion. From the point of infection upwards the trees under notice had been killed outright.

When large trees are attacked the spread of the fungus in the bark is apparently not so rapid; it lies more or less dormant during the hot, dry summer months, but starts again into activity in early spring and autumn. In extended attacks such as this, gumming is a common feature, and at first sight might easily be taken for the damage caused by the "Collar Rot" fungus. On one large lemon tree I observed no less than thirty-seven distinct areas of infection. On the main stem and branches there were many diseased spots which exuded gum freely, while many of the smaller branches had been completely girdled and killed beyond the portion affected (Figs. II., II.A). This tree is interesting as an example of the destruction which may follow upon neglect. When trees have arrived at this stage of disease their death is only a matter of course, unless control measures are adopted at once.



The Grey Mould or Botrytis Disease of Citrus Trees.

MICROSCOPICAL FEATURES.

Sections were cut which included portions of the diseased and apparently healthy bark. These when stained by the hæmatoxylin and alcoholic eosin method revealed the fact that a dense mycelium was present, not only in the discoloured portion, but for some distance in the still green bark (Fig. III.). The mycelium penetrating at first kills the cells, which is followed by their breaking up and absorption by the fungus. Strips of bark when removed with every care and placed under suitable conditions develop in some cases a dense white mould without evidence of spore formation, but in others a greyish-brown mould at the junction of the diseased and healthy bark. This last development was recognised as *Botrytis*, and the measurements of conidia approached closely to those of *Botrytis cinerea* Pers., viz., $12 - 13 \times 8 - 9$ microns (Figs. IV., IVA, highly magnified). Subsequently many specimens were obtained in the field from citrus trees with the *Botrytis* developed along the margin of the diseased parts. Conidia from these specimens had the same measurements as those obtained from the prepared strips of bark.

LIFE HISTORY OF THE FUNGUS.

The following is a brief account of the life-history: The grey mould or *Botrytis* fungus is both a saprophyte and parasite, that is, it can live upon dead vegetable matter, and under favorable conditions become a destructive parasite. This greyish mould produces vast numbers of conidia. These are the chief means by which the disease is spread. There is, however, another method by which the fungus can be reproduced, and that is by dense, compact, more or less spherical, masses of felted mycelium known as sclerotia (Fig. V.). These hard black bodies are, in fact, a resting stage, by which the fungus bridges over unfavorable weather conditions. In due time the sclerotia produce spores which, upon germination and fructification, produce the well-known grey mould, thus completing the cycle.

GENERAL REMARKS.

In the field it was found that when diseased citrus twigs or portions of the stems were placed on the soil surface, conidia and sclerotia developed, especially when the weather was wet or foggy. This point is well worth the growers' attention, as the disease, which has so many and varied means of reproduction, will be difficult to eradicate unless prompt measures are undertaken for its suppression on the first appearance in the citrus trees.

CONTROL.

All small infected branches should be cut out, and the infected parts of the larger branches and main stem should have all diseased material cut and scraped away. All prunings, chips, and scrapings obtained in the above operations should be carefully collected and burnt, all wounds made by pruning, &c., should be painted with a mixture of half carbolic acid and half water. Professor H. S. Fawcett, Plant Pathologist, State Commission of Horticulture, Whittier, U.S.A., has successfully held in control a disease which appears to be identical with our *Botrytis* on citrus trees by the application of a paste made as follows:—1 lb. of bluestone dissolved in a gallon of water, 2 lbs. of unslaked lime, slaked

in about half-a-gallon of water; when cool, mix. This paste is applied to the diseased places after they have been properly prepared by the removal of infected bark, &c. The above paste has also proved effectual against collar rot of lemon trees.

SUMMARY.

From the position of the diseased area in the young lemon trees mentioned above, viz., about 1 foot to 1ft. 3in. above the soil surface, it is probable that the infection took place through wounds caused during cultural operations. From numerous observations there is, I think, little doubt that *Botrytis* is a wound parasite, and, therefore, all wounds in citrus trees should be treated with one of the above-named mixtures at the earliest possible moment after infliction. This is more necessary if the weather is wet, the moisture content of the air being a factor in the development of this disease, that is to say, a wound to which conidia have gained entrance during dry weather is not so likely to set up infection as wounds in which conidia find lodgment just prior to, or during, rainy weather.

Quite recently a number of seedlings of *Eucalyptus citriodora* and *Jacaranda mimosæfolia*, some of which had been badly injured, and others killed, by a fungus disease, were forwarded for examination. The cause of injury and death to these seedlings was found to be due to the same fungus as that injuring the citrus trees mentioned herein.

THE CULTIVATION OF MEDICINAL PLANTS.

Contributed by the Medicinal Plants Board Sub-Committee.

The question of the production of medicinal plants and herbs is becoming a live one in Australia at the present time. The continent of Europe has been the main producer of drug and medicinal plants required here, and, owing to their abundant production, we have allowed ourselves to be dependent upon Europe for our necessary supplies. Owing to the war, these supplies have been very much reduced; it is therefore, well for Australia to concentrate all endeavours so as to be independent of external sources, and to produce as many and as much of the required medicinal drugs as the soil and climate will permit.

In order that full information on the important question of suitable plants and satisfactory conditions for their production may be given, a Medicinal Plants Board is now considering these and other vital phases of the cultivation of such plants. And until such time as the Board has determined several main and important questions, it will be advisable for those who are considering the growing of these plants to exercise due caution, and either make inquiries from the various wholesale chemists as to their requirements, or to wait until the report of the Expert Sub-Committee is published.

It is intended by the Board that experiments shall be carried out with between thirty and forty plants, which will be grown in the various soils and climates that are deemed suitable to their growth. The plants will then be tested and analyzed, and when satisfactory conditions are obtained, reports and recommendations will be issued. The Department of Agriculture, the Education Department and its High Schools, the Melbourne University, and the Melbourne Hospital are co-operating in this work.

For the present, a number of plants are receiving attention, and they are those whose medicinal properties are considerably in demand. The list of these plants is here given:—

1. Aconite	<i>Aconitum Napellus.</i> Linn.
2. Beech	<i>Fagus sylvatica.</i> Linn.
3. Belladonna	<i>Atropa Belladonna.</i> Linn.
4. Bitter or Seville Orange	<i>Citrus aurantium</i> var. <i>Bigaradia.</i> Hook. F.
5. Buchu, or Bucku	<i>Barosma betulina.</i> Bart and Wend.
6. Cascara Sagrada	<i>Rhamnus Purshiana.</i> D.C.
7. Meadow Saffron	<i>Colchicum autumnale.</i> Linn.
8. Foxglove	<i>Digitalis purpurea.</i> Linn.
9. Gentian	<i>Gentiana lutea.</i> Linn.
10. Golden Seal	<i>Hydrastis Canadensis.</i> Linn.
11. Henbane	<i>Hyoscyamus niger.</i> Linn.
12. Juniper	<i>Juniperus communis.</i> Linn.
13. Licorice	<i>Glycyrrhiza glabra.</i> Linn.
14. Lobelia	<i>Lobelia inflata.</i> Linn.
15. Male fern	<i>Dryopteris (Aspidium) Filix mas.</i> Schott.
16. Opium poppy	<i>Papaver somniferum.</i> Linn.
17. Peppermint	<i>Mentha piperita.</i> Smith.
18. Broom	<i>Cytisus scoparius.</i> Linn.
19. Senega	<i>Polygala senega.</i> Linn.
20. Senna	<i>Cassia acutifolia.</i> Deble. <i>Cassia angustifolia.</i> Vahl.
21. Stramonium	<i>Datura Stramonium.</i> Linn.
22. Strophanthus	<i>Strophanthus Komle.</i> Oliver.
23. Dandelion	<i>Taraxacum officinale.</i> Wiggers.
24. Valerian	<i>Valeriana officinalis.</i> Linn.
25. Viburnum	<i>Viburnum prunifolium.</i> Linn.
26. American Wild Cherry	<i>Prunus serotina.</i> Linn.
27. Witch Hazel	<i>Hamamelis virginica.</i> Linn.
28. Anise	<i>Pimpinella anisum.</i> Linn.
29. Castor Oil plant	<i>Ricinus communis.</i> Linn.
30. Camphor tree	<i>Cinnamomum camphora.</i> Nees and Eber.
31. Rhubarb	<i>Rheum officinale.</i> Linn.
32. Lavender	<i>Lavandula vera.</i> D.C.

On considering the above list, it will be readily understood that a very extensive amount of investigation will be needed before any pronouncement can be made. There are plants from every continent, and from very many latitudes, all requiring different soils and temperatures, with varying aspects and altitudes; and it will not only be satisfactory to decide that a certain plant will thrive in a certain soil and district, but to ascertain definitely how and where the plant may be grown so that it will give the best and the necessary results.

Then further consideration must be given to the economic habits of the plants themselves; for such plants as henbane and the opium poppy would be dangerous unless grown under proper supervision; while some

are even now present with us as weeds, such as the dandelion and the stramonium; others are easy of growth, like the licorice and peppermint; and it is necessary regarding the rhubarb and others to ascertain definitely the correct species and variety to be grown to give the most profitable results.

This question is also engaging the attention of the authorities in England, and last year the Board of Agriculture issued a leaflet (No. 288) on the growth of these plants. The following extracts from the pamphlet will show its character:—

Medicinal herbs have been cultivated in this country for centuries, and in the middle ages were grown in kitchen gardens attached to monastic establishments and the mansions of noblemen. At the present day farms exist at Mitcham, Carshalton, Hitchin, Amptill, Long Melford, Steppingley, Market Deeping, and Wisbech, but for many years the main source of British drugs has been mid-Europe, particularly Germany and Austria-Hungary.

During recent years the acreage devoted to drug cultivation in Britain has been more and more restricted by competition with wild foreign products, and the result has been a slow but sure ousting of British-grown drugs from the market. The advent of the European war has completely changed the situation, and an effort on the part of growers and drug merchants may largely secure for England the collection and cultivation for the future of medicinal plants which can for the present no longer be imported from Central Europe. Supplies of drugs, especially of belladonna, leaves and root, are much in demand, but in the case of other continental drugs grown in England the shortage is not so serious.

The price of belladonna has risen seriously (more than 100 per cent.) since the outbreak of war, and as it takes at least two years to grow this drug in quantity, the drug grown next year is likely to realize high prices. This applies in lesser degree to chamomile, dill, dandelion, and valerian. The prices of colchicum, digitalis, fennel, henbane, stramonium, and botanical herbs must also be considerably affected.

The limited outlet for most drugs makes overloading the market a comparatively easy matter, and any grower who proposes to devote attention to the cultivation of medicinal plants should give the matter careful consideration before embarking on it to any serious extent. For a number of growers, however, who can successfully raise good crops, handsome profits should be made in the near future.

Co-operation.—The most important drug industry—Cinchona bark production—has witnessed quite recently the fruits of co-operation between producer and manufacturer in restricting the output within reasonable limits. So far, consumers appear to be unaffected, while all other handlers of bark and quinine, other than speculators, are in a decidedly better position. Some arrangement might perhaps be made to insure British drug growers a fair return for their efforts. Co-operation between growers and wholesale druggists would probably prove effective.

Soil and Manuring.—Soil in good condition for ordinary farm crops is suitable for growing most medicinal plants. In general, care should be taken to keep down weeds and insure a good tilth. A medium dressing of farmyard manure is usually advantageous, although not actually necessary.

Drying of Crops.—The drying of medicinal herbs is a matter of great importance, and regular growers have proper drying plant, heated artificially so that quantities of the drugs can be dried quickly and thoroughly in a current of warm air. Facilities for drying purposes are necessary to the grower of medicinal herbs. Glass houses could readily be converted into drying sheds, especially if heated by pipes. Drying can be done in half-shade in fine summer weather by spreading thin layers of the leaves on sheets in the open, or on racks or shelves in a freely-ventilated shed, turning frequently until quite dry. The leaves or flowers must be kept under cover at night or during rain. "Even colour" is best retained by quick drying, and the brighter the colour the more saleable the product. Those who intend to market dry leaves or flowers could gather and dry in small portions, which are more manageable. Roots present less difficulty in washing and drying.

The most important British drugs are dealt with briefly here, while a number of others are also mentioned, though their supply is more or less restricted.

The South of England is especially suited to drug-growing, and is further favoured in being close to the principal consuming market.

The greatest trouble to be encountered by the grower will be to obtain sufficient seeds or dormant plants to start growing medicinal herbs.

Aconite (Aconitum Napellus, L.).—The chief collecting centres for foreign aconite root are the Swiss Alps, Salzburg, North Tyrol, and Vorarlberg. Swiss supplies, which have come *via* Germany, may be cut off as well as the others. Supplies of Japanese aconite root are plentiful, and Spanish root is also coming into the market, so that the demand for English aconite will probably be restricted. The price of the continental root is about 50s. per cwt., and Japanese (usually ascribed to *A. Fischeri*, Reichb.), about 35s. per cwt., while English is ordinarily worth 2s. a lb. Cultivation of aconite has not paid in recent years, even with cultivated root four times the price of wild. Leaves are of little importance.

Belladonna (Atropa Belladonna, L.).—The bulk of the world's supply of belladonna is derived from wild plants growing in quantity on waste, stony places in Southern Europe. The industry is an important one in Croatia and Slavonia (South Hungary), some fifty exporters being engaged in buying the root and leaves from collectors and exporting the drug chiefly to Wurtemberg. The largest exporter in Slavonia sent out 29,880 lbs. of dried belladonna root in 1908.

Continued shortage will almost certainly exist during the next few years. If seeds are sown in October, a small crop of leaves may be obtained in the following year if the plants grow strongly. High prices will probably continue until the root is dug three or four years hence. It is usually difficult to obtain more than £10 per acre for a crop of belladonna, but those who contract to deliver belladonna next year should obtain more than this for the sparse first year's cutting.

Dandelion (Taraxacum officinale, L.).—Dandelion has been scarce throughout 1914. English roots have usually been sold in competition with German roots at about 40s. per cwt., but 110s. was being paid in September. In the early part of this year fresh root was worth 6s. per cwt. Unless this year's collection is much greater than usual, the

absence of German competition will keep prices high. Farmers might collect and dry the roots or arrange with the middleman for this to be done for them. An advantage of this course is that the weed is reduced.

Foxglove (Digitalis Purpurea, L.).—The continental supplies of digitalis leaves from Thuringia and the Harz Mountains are stopped; but there should be enough of the wild plant in England to satisfy home requirements if it can be collected. Dry wild leaves would be worth 35s. per cwt. and upwards. Unless these are gathered in considerable quantity there will be a shortage next year.

The foxglove is cultivated by a few growers in this country for a very limited market, in order to provide a drug of more uniform activity from a true type of digitalis purpurea.

Golden Seal (Hydrastis Canadensis, L.).—Golden seal is an American drug, the price of which has risen from 5s. per lb. in 1905 to 20s. or more in September, 1914. Such a high price enables cultivation to be practised on a commercial scale both in America and in England, even with the great expense of artificial shading in order to simulate natural conditions. Cultivation of this drug might become a paying proposition to any one who could solve the problem of the correct conditions of shade and moisture. Several times the amount of drug now used would be absorbed for making fluid extract of hydrastis and the alkaloids hydrastine and hydrastinine.

Henbane (Hyoscyamus Niger, L.).—This biennial is cultivated in this country for extract making. There is a limited demand for this purpose, and the established drug farms will probably be able to meet it. The official henbane leaves of the British Pharmacopœia are the leaves and flowering tops of the second year plants of biennial henbane, but the dry commercial leaves imported from Germany and Russia are derived from the wild annual. The plant might be grown next year to make good any shortage, if good germinable seed can be obtained. There will be a demand for dry leaves at enhanced prices next year. The normal price of the continental drug plant is 40s. to 45s. per cwt. The English-grown plant is ordinarily worth 3s. to 6s. per lb.

Opium Poppy (Papaver somniferum, L.).—The white variety of the opium poppy is still grown in several parts of the country, notably Lincolnshire, for the sake of its capsular fruits. The crop is always a precarious one, but there is a steady market for poppy heads. Belgium usually supplies a proportion of the poppy heads used in this country, but not sufficient for the loss of her crop to cause serious shortage next year.

Thorn Apple (Datura Stramonium, L.).—The thorn apple is not grown on a commercial scale in this country. The principal use of the drug is as an ingredient in burning powders for asthma, considerable quantities of wild leaves being imported from Germany and Hungary. The normal price of foreign stramonium leaves is about 40s. per cwt., but 80s. has been asked since the outbreak of war. The seed is also a commercial article, but demand is very limited. The plant is an annual, and easily grown. The dry leaves would find a ready market next year.

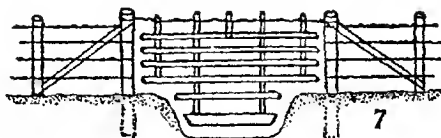
Valerian (Valeriana officinalis, L.).—Valerian is common in England in moist situations. Most of the drug plant of commerce consists of rhizomes from plants grown in Derbyshire, or imported from Holland, Germany, and France. The foreign root was selling in January at 30s.

per cwt., English being worth 1s. to 1s. 3d. per lb., about four times that price. Very little valerian is now cultivated in this country, and great scarcity already exists. Abnormal prices will be paid for some time to come.

In addition to the above, a considerable amount of space is devoted to many other plants, and to the necessities and modes of cultivation of each plant listed. It is not thought necessary to repeat those here, for conditions will probably vary considerably in Australia. It will thus be seen that, while there is every reason for the local production of these plants, and that in the near future their growth will be readily undertaken by many, it will not be wise to embark upon the undertaking of medicinal plant growing until the experimental stage has been passed. Intending growers must be prepared to take up the project, so that a considerable quantity will be produced. Buyers will neither require ounces nor pounds, but in many cases, hundredweights; and for this reason alone, it is well that the question is being investigated on a scientific basis, so that growers shall be assured success from the initial stages.

CHANNEL GATE.

A convenient water gate is illustrated in *Handy Farm Devices*. Two stout posts are set 3 feet in the ground, and about 6 feet back from the banks of the channel, well braced and stayed. A piece of plain or barbed wire is run across and back, between the posts, about six times, and fastened securely at each end. A piece of 3 x 1.



about 4 feet long, is placed between the two sets of wires at the middle, and turned around until the wires are well twisted together. The gate is constructed of timber, as shown in the illustration, and hung by stapling on the wires at the top.

THE POTATO MOTH.

Phthorimaea operculella, Zeller. *Lita solanella*, Bois.)

RECENT SPRAYING EXPERIMENTS IN GIPPSLAND.

By C. French, Junr., Government Entomologist, and S. G. Harris,
Senior Potato Inspector.

According to various writers this destructive pest of the potato crop has been known in Australia since 1854, and has spread to all the States. It has caused considerable losses to growers, and is certainly the worst potato pest in the Commonwealth. Potato moths have been exceedingly plentiful during the past two seasons, owing to the exceptionally dry weather conditions, and in Gippsland and elsewhere the damage caused by these insects has been very great. In some cases the whole crop was destroyed, when the plants were from 4 to 6 inches high, and in many instances growers had to discard fully two-thirds of the tubers when bagging owing to the depredations of the caterpillar. They are usually more plentiful after a mild warm winter. There are two broods of moths. The first, the winter brood, may destroy the young plants and thereby ruin the crops. The moths of the second brood deposit their eggs on the potatoes themselves, when the tubers are stored or are in the field. Occasionally, especially if potatoes are grown in stiff soil, the moths will crawl down the cracks into the ground and deposit their eggs on the tubers. The eggs are usually from 20 to 30 in number, and hatch in from six to ten days. In sandy soil tubers are rarely so attacked. The young grubs when hatched usually feed upon the eyes of the potatoes; they then tunnel towards the centre of the tubers, causing them to become brownish black, and inducing decay. When the potato plants have made substantial growth the female moth deposits her eggs on the leaves. The young grubs feed on these leaves and afterwards gnaw their way down to the main stalk and are distributed over the surface of the soil, occasionally reaching the tubers below, and immediately attacking and destroying all tubers exposed in the drill or scattered on the surface. Fortunately for growers, the chrysalids of the potato moth are destroyed by parasites, insectivorous birds, bacterial diseases and climatic influences.

LIFE-HISTORY.

The eggs are very minute of a white colour and glistening.

Caterpillar.—When fully grown it measures about $\frac{1}{4}$ inch in length, and is of a faint pinkish colour with a brown head. It usually pupates under the skin of the potato, and is surrounded and protected by dirt, excrement, &c.

Chrysalid.—The pupa or chrysalid is dark brown in colour, and is enclosed in a silken bag or cocoon.

Moth.—The moth is small, of a light brownish grey colour, the size being, body about $\frac{1}{4}$ inch in length; front wings, which are darker

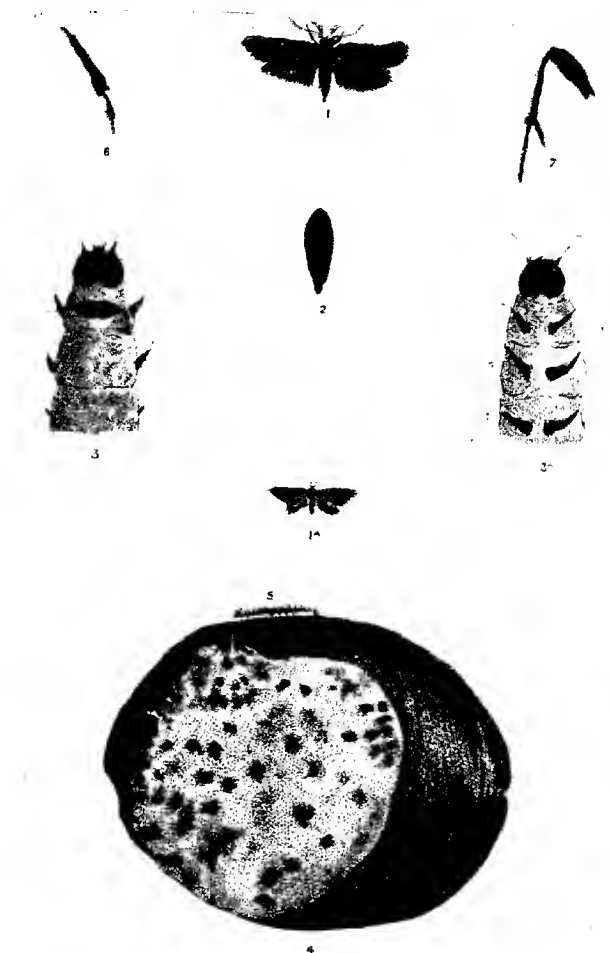


Plate V.—Potato Moth. (*Phthorimaea operculella*, Zeller).

EXPLANATION OF PLATE.

- Fig.
I. Moth. Magnified.
Ia. Moth. Natural size.
II. Pupa. Magnified.
III. Head and first three segments of larva.
Upper side. Magnified.
IIIa. Head and first three segments of larva.
Under side. Magnified.

- Fig.
IV. Potato sliced to show effect of attack by
larva of moth. Natural size.
V. Larva. Natural size.
VI. Fore leg. Moth.
VII. Hind leg. Moth.

than the hind ones, female, about $\frac{1}{2}$ inch across when expanded, male slightly smaller. The wings of both sexes are feathery or fringing, but this is not so pronounced in the male as in the female.

PREVENTION AND REMEDIES.

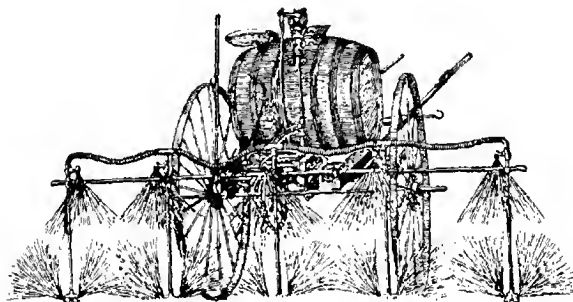
Dead potato plants, discarded and small potatoes, and rubbish should be gathered and burnt. Old sacks and cases in which there have been infected potatoes should be dipped into boiling water. By this means any grubs and chrysalids secreted in them will be destroyed. Seed infested with grubs should never be planted. Where the soil conditions will permit the sets should be planted deeply, and in shallow soil the drills should be sufficiently wide apart to allow of hilling, and as the potatoes develop there should be at all times a good depth of mould covering the top layer of tubers. When the moth is in evidence during digging operations the potatoes should not be allowed to lie on the surface, but as each stalk is dug the tubers for market and seed should be immediately gathered into the bucket or bag, and if the bag is dipped in water before being filled it will tend to close up the material and prevent the caterpillar from entering it through the spaces where it comes into contact with the soil. When the potatoes are bagged, the bags should at once be sown up and removed to the storeroom, where moths cannot get at them to lay their eggs in the eyes of the tubers. It is advisable for growers to erect bins, which could be made moth proof, and if necessary airtight. These could be used for storing purposes, and if airtight, for the fumigation of seed potatoes to destroy the caterpillars of the moth. Recent fumigation experiments with bisulphide of carbon have proved effectual. The quantity used is 3 lbs. of carbon bisulphide for every 100 cubic feet of air space enclosed. The potatoes should remain in the bins from four to six hours. Great care should be exercised in using this chemical, as it is highly inflammable. It is a common practice with many growers to throw a few handfuls of potato plants which are probably infested with the caterpillars of the moth over the top of the sack containing the newly dug potatoes and leave them in the field for days. The consequence is that the caterpillars are distributed throughout the contents of the bag, and tubers which have been carefully sorted for market or seed are infested with the grub. This neglect of the grower was very noticeable in parts of Gippsland which we visited this season. Another bad practice is to heap the potatoes up in the storeroom without any covering, and to leave the doors wide open. It is no wonder that losses occur.

Trapping by means of lamps is of use in destroying the moths which fly about at night. Procure an ordinary tin basin, and in this place a brick and enough kerosene to reach half-way up the brick, and on the brick a lighted lamp. The moths are attracted to the light, and flying against the lamp fall into the kerosene, where they are destroyed. The basin could be placed on an ordinary box, such as a kerosene case. Several of these lamps could be placed in a field of potatoes at night time.

When the moths commence to make their appearance, it is advisable to spray the crop with some arsenical spray, such as arsenate of lead. This will destroy the young grubs as soon as they commence

to feed. As many reliable brands of arsenate of lead are on the market, and at a fairly cheap rate, the growers prefer to purchase the ready-made article instead of going to the trouble of mixing this excellent spray themselves. As a deterrent against moths depositing their eggs on the plants coal tar water may be used. The formula is as follows:—Boil 1 lb. of coal tar in 2 gallons of water, and while hot add from 50 to 100 gallons of water.

In cases where spraying is to be done, spaces might be left between every few rows of potatoes for the horse drawing the spray pump to pass, otherwise many of the plants will be trampled down. During a recent spraying demonstration of potatoes, this oversight on the part of the growers was very noticeable. At the present time, some excellent motor, automatic, and other spray pumps specially designed for potato spraying are on the market, the nozzles being made so that the whole plant may be thoroughly sprayed. Six or more rows of potatoes can be sprayed at the same time. Recent experiments by the writers and other officers of the department prove the value of these pumps, which are now coming into general use.



The "Fleming" Automatic Potato Sprayer.

Many reports having reached the Department of the damage caused by the potato moths this season, it was decided that experiments should be carried out to convince the growers that by early and careful spraying this pest could be kept in check. For that purpose it was arranged to conduct an experiment with an arsenate of lead spray at Iona. Most of the leading growers of the district were present. The first plot of about one acre was a strip in the centre of a field of potatoes. The land was very dirty, in some places the weeds almost covered the potato crop, and there were doubts of the result at the time of spraying, but agreeably to our surprise it was found that the result had outstripped our anticipation, and very little trace of the grub was found in the tubers; in fact, none except where they were exposed above the soil. This result was obtained despite the fact that within a chain or so where digging operations were in progress unsprayed potatoes were rather badly affected. The owner informed us that, when the crop was green, he walked through it almost every evening, and that, while the other parts of the field were swarming with the moth,

there was practically no sign of them in the sprayed part. He is quite convinced of the efficacy of the spray to destroy the moth if used under fair conditions.

The area sprayed was one acre, and the cost of the material 2s. 6d. per acre. A larger area would have been dealt with, but owing to the dry season it was difficult to obtain water for further experiments.

No. 2 plot was sprayed by the grower, Mr. Allan Macdonald, of Garfield, at a subsequent date, and comprised about three acres. He says it was a bit late when he got the machine, but after spraying the moth completely disappeared for some weeks; after a fall of rain they appeared again in small numbers, and that another spraying should then have been given, but the machine was not available. He further stated that he lost the whole of the crop last year through the moth, and is convinced, if he had sprayed, it would have meant a saving of over £400 to him. In fact, he is so favorably impressed that he intends purchasing a machine for next season.

A machine was also sent to Mr. J. Kneebone, Myrtleford, but owing to press of work we could not get away to supervise the work, but full instructions were forwarded by letter. At a subsequent date a visit was paid to the district by Mr. Harris, and it was found that the machine had also been used by Mr. Phillips, of Whorouly, but it had not been satisfactory owing to the fact that the spraying was not commenced sufficiently early. From what could be gathered from conversations with the growers mentioned, it was quite evident that had it been possible to visit the field at the time the machine was sent advice would have been given that no action be taken, as the crops were too far gone. Early spraying is necessary, and if the moths are plentiful it is advisable to spray several times. All weeds should be destroyed; this precaution is very often neglected. Many plants belonging to the Solanaceæ, especially *Solanum nigrum*, the Black Night-shade on which the moths also feed, are allowed to grow the whole year round on the potato field. If this neglect is not remedied, the growers will have the pest with them at all times. Arrangements have been made for a demonstration to be given in the district next year if the moth shows evidence of becoming troublesome.

Knapsack spray pumps can be purchased from 50s. for small plots, and motor spray pumps from £80 to £100, but the pump illustrated is the type that has been adopted, after several trials, by the Department, and can be purchased for £35 with iron droppers, and £37 10s. with copper droppers.

Where branches of the Victorian Potato and Onion Growers' Associations have been formed, the question of purchasing one or more machines by co-operative effort for joint use amongst small growers is submitted for the consideration of the executive of the Association and its branches.

As the potato moth is proclaimed an insect pest under the Vegetation Diseases Act it would be advisable that the potato inspectors should inspect all storerooms in the country districts where potatoes are grown and see that every precaution is taken by growers to protect the tubers from the ravages of this moth. One careless grower in a district can breed enough moths to ruin all his neighbours' crops, and it is against such a grower that action should be taken. In our opinion, owing to growers neglecting to keep the moth in check, potato spraying should be made compulsory.

BEE-KEEPING IN VICTORIA.

*F. R. Beuhne, Government Apiculturist.*XXVI.—THE HONEY FLORA OF VICTORIA (*continued*).*(Continued from page 486.)*THE MEALY STRINGYBARK (*Eucalyptus cinerea*, F.v. M.).**(Fig. 30. Upper part of plate.)**

A moderate-sized tree, flowering already in the shrubby state, the trunk is comparatively short, with branches at from 10 to 15 feet from the ground even in aged trees; the wood is twisted and brittle, and of inferior value, the bark fibrous but not distinctly stringy, light-brown to grey outside and light-brown with a reddish tinge inside; usually only the upper branches are smooth.

The foliage has a variable whitish or ashy bloom. The leaves either stalkless and opposite, and heart to egg-shaped, as seen in the illustration Fig. 30, 1A, 1B, 5, and 6, or broad-lance and even narrow-lance shaped on short stalks, as shown at 3 and 4, or of an intermediate shape as at 6, while sucker and seedling leaves are almost round (2). The lance-shaped leaves are found more on aged trees, and become even alternate or scattered instead of opposite, but broad and lance-shaped leaves are often found on the same tree; the veins of the leaves are very spreading, not conspicuous, the marginal veins remote from the edge.

The flowers are at the shoulders of leaves in threes, only exceptionally at the end of branchlets, which latter are thin and round. The buds are half round, pointed or conical to broad conical; the fruits small, half round top-shaped, three to four, rarely five celled. This tree flowers from October to December, and although it does not perhaps rank high as a nectar producer, it is like some others, enumerated to enable the reader to distinguish it from others of greater apicultural or timber value.

The mealy stringybark is found in Victoria, in the North-Eastern district, where it is known as turpentine tree, on account of a somewhat terebinthine odour of the bark, or as silver-leaved stringybark; this name has now, however, been adopted for a variety slightly different and growing in the south-eastern parts of the State.

THE SILVER-LEAVED STRINGYBARK (*Eucalyptus cinerea* variety *multiflora*.)**(Fig. 31. Lower part of plate.)**

A tree usually of medium size, but it may attain a height of about 100 feet, bark softly fibrous, greyish to brown outside, reddish-brown inside, and on old, stunted trees in swampy ground of great thickness in comparison with the size of the tree. Timber reddish, inferior in quality, soft short grained, and often hollow when growing on low ground.

The leaves of suckers and young saplings are broad egg-shaped (7, lower part of Fig. 31), or heart-shaped, stalkless and opposite, changing in older trees to longer and narrower short-stalked opposite (8A), or narrow lance-shaped scattered leaves (8B), but all kinds are

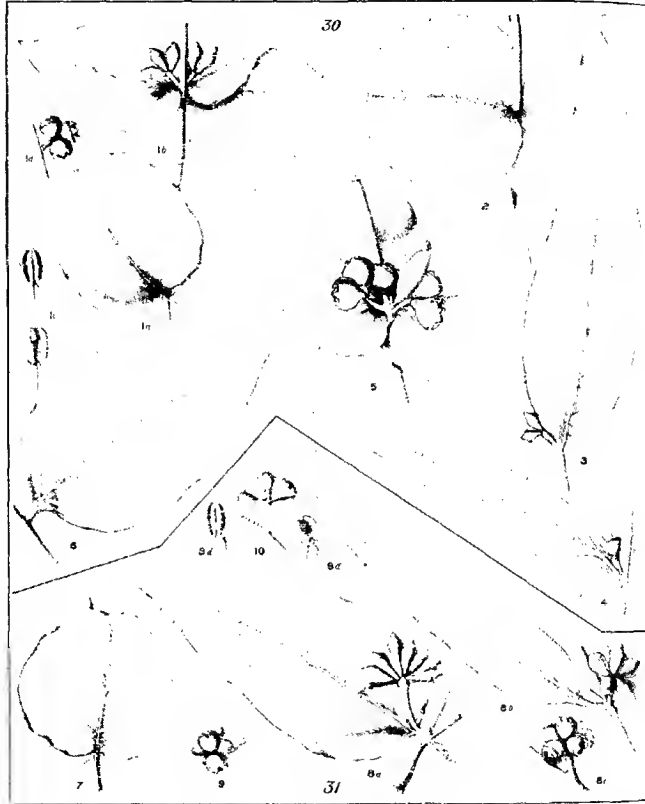


Fig. 30.—The Mealy Stringybark
(*Eucalyptus cinerea* F. v. M.). Upper part of Plate 1-6.

Fig. 31.—The Silver-leaved Stringybark
(*Eucalyptus cinerea* variety *multiflora*, Maiden). Lower part of Plate 7-10.

quite commonly found on the same adult tree. Young foliage, as also buds and branchlets, frequently covered with a white or bluish bloom, giving the tree a silvery appearance, hence the local name "Silver-leaved stringybark."

Flowers in umbels of four to eight at shoulders of leaves; the buds conical pointed; fruits small, half round to top shaped.

This tree appears to be confined to the eastern half of Victoria, and particularly the south-east; from the vicinity of Melbourne to Omeo and Buchan it is found in many places in districts with a good rainfall,

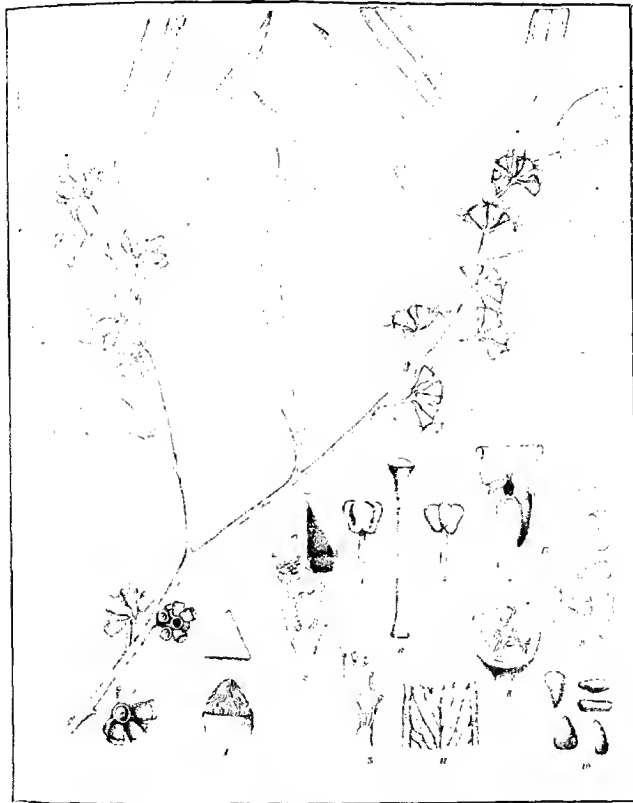


Fig. 32.—The Scented Peppermint (*Eucalyptus odorata*, Behr).

generally on poor soil on low sandy heath country, or on bayonet-grass flats (where it is often the only tree), but also on low hills, near or intermingled with messmate (*E. obliqua*) and narrow-leaved peppermint (*E. amygdalina*). As a timber tree it is almost worthless; even for fuel purposes it is inferior; but to the beekeeper in the localities where it

grows it is a valuable tree, furnishing an autumn supply of nectar and pollen, which enables the bees not only to accumulate winter stores, but often also to store surplus and always to keep up brood rearing till quite late in the season. In this respect it takes in the eastern part of the State the place of the long-leaved box (*E. laeophora*), which is so highly appreciated by the apiarists of the drier districts, on account of the successful wintering of the bees always connected with its flowering.

The silver-leaved stringybark, which is also known by several other names, such as apple tree and red stringybark, flowers every second year from March to May or June, and is freely visited by bees even so late in the season when frosts occur at night. The honey granulates or candies somewhat coarsely, but never very hard, and although it is one of the darker kinds, it is yet one of the best flavoured of the localities producing it.

THE SCENTED PEPPERMINT (*Eucalyptus odorata*).

(Fig. 32.)

A medium-sized or rather small tree, with greyish rough hard box bark, hence also called box tree. It is classed as one of the peppermint trees on account of the scent of the leaves, which suggested the specific name "odorata." The timber is of fair quality, although seldom of large dimensions; it lasts well underground, is very tough, and used in a manner like that of yellow box (*E. melliodora*), of which it is an allied species; the habit of the two trees is much the same, but the scented peppermint is found chiefly on limestone ridges principally in the north-west of Victoria.

The leaves are scattered, narrow lance-shaped, rarely broad, often on comparatively short stalks, rather dull-green or somewhat shining, of equal colour on both sides; the clusters of flowers occur singly at the shoulders of leaves or in short sprays with from three to nine flowers; the buds are broad conical to pointed, half round, tapering into the short stalklet; the fruits bell-egg-shaped, three to five celled. This species appears to have been overlooked by apiarists, and, in consequence, nothing can be said regarding nectar and pollen production. It is hoped, however, that the description and illustration of this and some other eucalypts now published will be the means of obtaining this information for future use.

THE BULL MALLEE (*Eucalyptus Behriana*).

(Fig. 33.)

A tall shrub or small and perhaps never a tall tree, which may be said to form a connecting link between the tree eucalypts and those of a shrubby type included under the general term of Mallee.

The outer bark is brownish or dark, and shed in large flakes, leaving the surface of the stem and main branches smooth and greenish. The foliage is rather massive, leaves scattered, broadish or oval lance-shaped, of thick consistence, of equal colour and shining on both sides, not at all or only slightly curved, occasionally tinged with whitish bloom. The veins of the leaves are somewhat prominent, rather distant, the marginal vein distinctly removed from the edge of the leaf.

The clusters of flowers, seven or less in each, are in sprays; the buds are blunt or half-round ended, not angular; fruits small, cylinder-shaped or top-shaped, oval, three or oftener four celled, with a narrow rim.

In its relationship the bull mallee approaches closely to the grey-box (*E. hemiphloia*), from which it mainly differs in never attaining the stately dimensions of that species; in the bark remaining smooth from

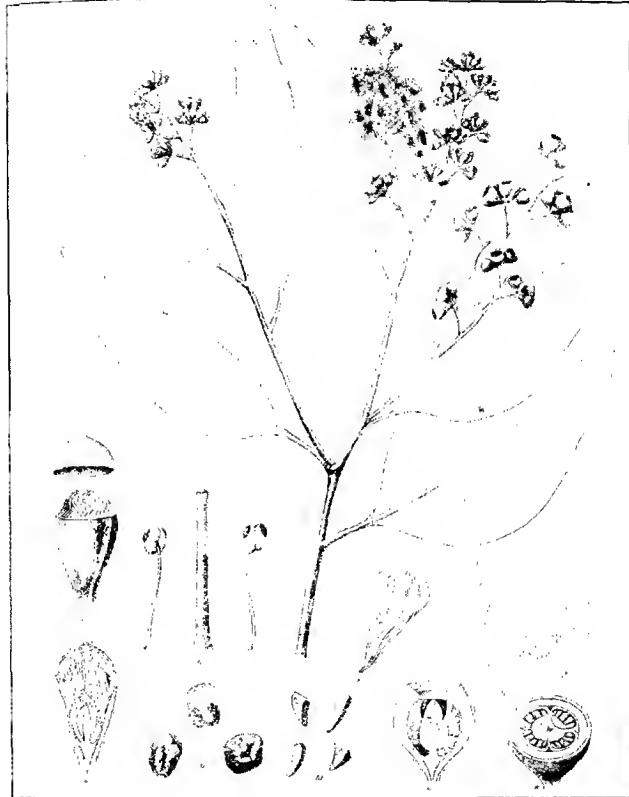


Fig. 33.—The Bull Mallee (*Eucalyptus Behriana*, F. v. M.).

the shedding of the outer layers; besides, the leaves are, as a rule (with exceptions), shorter and broader, the sprays of flowers are less ample and the flowers and fruits smaller, their stalklets shorter and the buds blunter than those of the grey box (*E. hemiphloia*).

The bull mallee (*E. Behriana*) claims also near affinity with black box (*E. bicolor*), but the bark of the latter does not shed, the leaves are

narrower, thinner, of duller hue, and finer veined, and the sprays of flowers more spreading; thus the resemblance of *E. Behriana* in foliage is closer to *Euc. hemiphloia*, but in flowers and fruits nearer to black box (*E. bicolor*), while in bark it differs from both. It is also related to *E. odorata*, the scented peppermint, but the latter has a box bark, and the clusters of flowers occur at the shoulders of leaves, not in sprays.

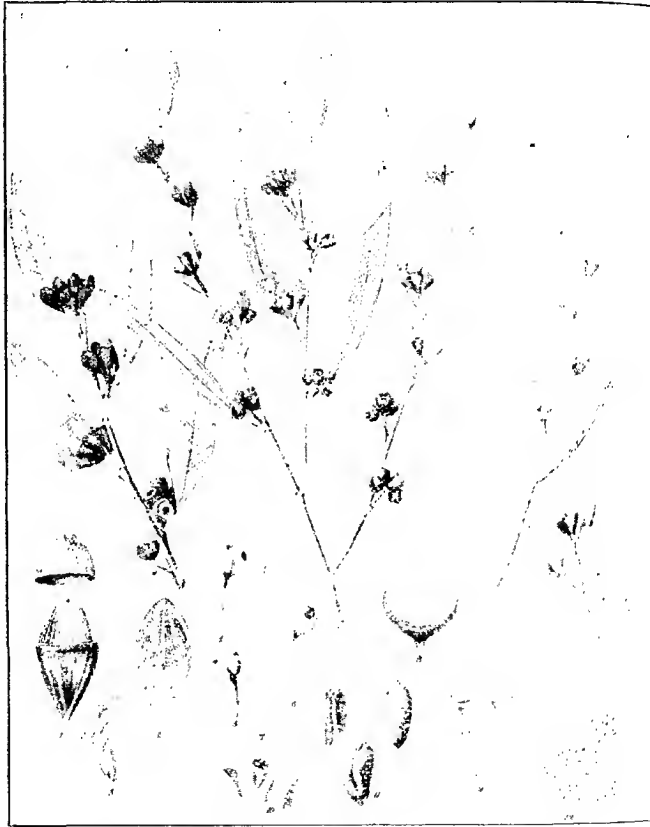


Fig. 34.—The Hooked Mallee (*Eucalyptus uncinata*, Turezanirow).

The bull mallee is found near the sources of the Werribee River, on stony hills, extending thence to the Avoca and the north-west. Nothing definite is so far known as to the character of the honey gathered from this tree, but it most likely resembles that obtained from grey-box, with which it also agrees in time of flowering and pollen production.

THE HOOKED MALLEE (*Eucalyptus uncinata*).

(Fig. 34.)

This species always remains of a shrubby growth, with several thin stems branched from near the base. It constitutes, chiefly along with the oil mallee (*E. oleosa*) and slender mallee (*E. calycogona*), a considerable portion of the Mallee scrub. The bark is smooth and greyish, or may assume on the branches and branchlets a dark hue, hence the name black mallee, by which it is known in some localities. Branches erect, never drooping. The leaves are scattered, on short stalks, usually narrow lance-shaped, of equal green on both sides and somewhat shining, occasionally they are broad lance-shaped, or very narrow and long, but always copiously dark dotted with oil glands. The veins exceedingly fine, rather close and spreading, but nowhere prominent, the marginal vein very close to the edge of the leaf which terminates (as in some other eucalypts) in a fine hooked point, from which feature in this instance the name is obtained. The clusters contain from three to nine flowers, and occur at the shoulders of leaves, or in short end sprays (occasionally), and on aged wood sideways from branchlets. The buds almost egg-shaped, but the lid sometimes narrow conical; the fruit small, half egg-shaped, mostly three, sometimes four celled.

The hooked mallee is one of those from the leaves of which eucalyptus oil is distilled.

As a nectar and pollen producer, this is one of the best of the mallee eucalypts known to beekeepers. It flowers profusely every second year during March, April, and May, lasting about twelve weeks. The buds appear three to four months before flowering.

The honey is of good quality, not very dense, but this slight defect is perhaps due only to the comparatively high humidity of the atmosphere at time of gathering, and can be rectified by running it from the extractor through a suitable heating apparatus, as is now being done by some apiarists with honey from other late flowering trees. It candies, but not solidly.

There are large tracts of the hooked mallee available for apiarists, and, as the flowering of this species alternates with that of yellow box and red gum in the western half of the State, it provides a profitable field for operations by moving the apiaries to it every second year and back to the forest country the following season.

Moreover, this particular mallee, and some others, grow chiefly on soil too poor for cultivation purposes, and the bee pasture is therefore more likely to be permanent.

(To be continued.)



WORKERS' COMPENSATION ACT 1914.

The Insurance Commissioner of the recently-established State Accident Insurance Office has passed on to the editor the following statement, which will be of interest to the farming community:—

It would appear that some employers—in the farming industry especially—are of the opinion that certain persons performing work for them are not “workers” within the meaning of the Act above quoted; but, on the contrary, are contractors, and therefore liability in respect of such persons under the Act is not existent, and it is not necessary to insure. It is only right, however, to remind such employers that the question of determining between a case of independent contract and the relationship of master and servant is often one of considerable legal difficulty—particularly so when the remuneration is based upon the amount of work performed, and in cases of doubt it is advisable to either effect an insurance or place the particulars of the case before the Insurance Commissioner, who will then advise the farmer as to the best course, in his opinion, to follow.

A fairly reliable test to ascertain whether the case is one of “principal and contractor,” or “master and servant,” is as follows:—Does the employer retain the power not only of directing what work is to be done, but also of controlling the manner of doing the work and the right of dismissal? Where this question can be answered in the affirmative, the employer may consider that there is every likelihood of his being liable under the *Workers' Compensation Act 1914*, to pay compensation for any personal injury by accident which may be sustained by a person who is engaged in carrying out the work. Under such circumstances, it would naturally follow that the necessity to insure would therefore be present.

In the case of many so-called “contracts” which are entered into by farmers for fencing, ploughing, ring-barking, potato digging, and the like, it will be found, upon an application of the foregoing test, that the arrangement made is not an independent contract at all, but instead, a “piece-work contract of service.” A man who is engaged at a “piece-work” rate of pay in lieu of a daily or weekly wage is, nevertheless, a “worker” within the meaning of the *Workers' Compensation Act*, and requires to be insured.

Apart from a certain tendency on the part of some employers to endeavour to enter into such an arrangement as is intended to constitute the position of a “contractor,” and not a “worker,” may be mentioned the fact of other employers now purposely following the practice of remunerating their employees by a “share in profits” instead of weekly wages. But here, again, the employer is not on safe ground as regards immunity from liability under the *Workers' Compensation Act*, as it has been laid down judicially that “the question whether a person is a servant of or a partner in a firm depends upon the intention of the parties, and must be decided by the terms of the contract”; and, again, “a contract for the remuneration of a servant or agent of a person engaged in a business by a share of the profits of the business does not of itself make the servant or agent a partner in the business.”

As regards the case of *bonâ fide* share farming, it is considered, on the authority of an appeal case heard before the Queensland Full Court, in October, 1910, *Korn v. Kano* and another, that the farmer "A," who owns land, and lets it on the share system to some other farmer "B," incurs no liability under the Act to farmer "B" or any men employed by him.

Another interesting position is that of a threshing machine proprietor who accepts contracts from farmers to cut their crops on their respective farms. Although the farmers in many instances—as part of the arrangement made—undertake to pay certain men who follow the machine on to the farm, and there get work in connexion therewith, it is not considered that the farmers incur any liability under the Act to such men, as they are really the servants of the machine proprietor while the machine is working on a farm, and he alone is liable. The mere fact of the farmer paying the wages is only a matter of arrangement with the machine owner, and is taken into account by the latter when fixing the price per ton at which the crop is to be cut. Were it not so, the contract price would be increased so as to include the cost of wages. Therefore the opinion is given that the threshing machine owner is the person liable whilst the men are actually working, and not necessarily in respect of the casual "followers" whilst they are on the road following the machine from farm to farm. The two or three permanent men (engine-driver and feeder) would, however, probably still continue their rights of recovery under the Act should they be injured by accident whilst the machine was on the roads.

The attached extracts from compensation law cases which have engaged the attention of the courts elsewhere—England, New Zealand, and Queensland principally—should prove of interest to those employers who may be labouring under a misapprehension when thinking that for a surety no liability under the Workers' Compensation Act attaches to them.

Mr. Holmes has intimated to the Editor his willingness to answer any inquiries in writing that employers may feel disposed to address to him upon the subject of liability under the Act. The address of the State Accident Insurance Office is : Oxford Chambers, 473-481, Bourke-street, Melbourne.

Employers are advised in their own interests to take advantage of the fact that the Government has provided them with an insurance office whose aim will be to afford them insurance under the Act at cost price. This course is only possible for the reason that the office is not expected to be a revenue producer, and any profits which may be made by the office are to be refunded to the policy-holders by a system of periodical rate revision and distribution of profits. At the same time, too, it is the intention to judge each separate policy and class of occupation on its own individual merits, so that a careful employer who adopts safeguards to minimise accidents will be rewarded, and not penalized, by having to "carry" the careless employer. Employers who are interested by the foregoing should write to the Insurance Commissioner for further particulars, or a copy of the balance-sheet of the first year's operations of the office.

EVANS V. THE PENWYLLT SILICA BRICK COMPANY (England).

It was held that a worker who was employed under a written agreement on the terms that he should be paid so much for every ton of material which he worked, was a worker at piece rate.

BAGNALL V. LAHEYS LIMITED (Queensland).

A man was engaged to cut scrub at 7s. per day, and afterwards the employer let him a section of pine to fell at 6s. per 100 feet, and 1d. per 100 feet bonus, as the section was completed. The employer directed into what lengths the pine was to be cut. No time was fixed for completion, and the employee could commence and cease work when he chose, but was bound to keep the mill supplied, the employer being the arbiter of the sufficiency of the supply. He could, if he chose, employ other labour, and he used his own tools. On several occasions while thus occupied he was directed to work otherwise, at 7s. a day. While engaged in felling pine an accident happened to the employee. It was held that he was a worker.

HERBERT V. EDELSTON (Queensland).

By a verbal contract Edelston agreed to ring-bark 200 acres of land on piece-work, at a remuneration of 1s. 3d. per acre, payable on the completion of the work, for which no time was fixed. Edelston was at liberty to begin work when he wished. Herbert showed Edelston in what manner he wanted the work done, and pointed out certain trees which were to be left untouched. Edelston engaged others to assist in the ring-barking, probably to the knowledge of Herbert. While engaged in this work Edelston's axe glanced from a tree and injured his knee. It was held that there was evidence from which it could be found that Edelston was a worker within the meaning of the Workers' Compensation Act (Q.) of 1905.

PENROSE V. POWELL (New Zealand).

Where the claimant was engaged in felling an unspecified area of bush to clear the land for farming purposes, at so much an acre, and was subject in all respects to the directions of the respondent. He was not a contractor, but was a piece-worker, and was within the Act.

MOONEY V. SHEEHAN, 1903 (Ireland).

A carter, who found his own horse and cart, and was engaged to carry hay at 9d. a ton, was in Ireland held to be a worker engaged by piece-work.

SMITH V. HORLOCK (England).

The applicant was employed as the master of a barge, on the terms that he was to receive half the net freights and to engage and pay the mate and boy, the owner only paying 5s. a week towards the boy's wages. It was a term of his employment that the owner was to fix the freight, and as regards the only voyage made by the applicant the freight had actually been arranged before he was engaged. The applicant had no choice where to go, but received orders as to his destination and places of call. The applicant said he was not liable to dismissal during a voyage. In an account sent by the owner to the applicant a deduction was made from the amount shown as due to the applicant in respect of his insurance under the *National Insurance Act 1911*. *Held*.—That the County Court Judge had not been justified in holding that the applicant was a co-adventurer, and not a workman within section 13 of the *Workmen's Compensation Act 1906*, and that the case must be remitted to him to assess the compensation.

JONES V. PENWYLLT DIVAN SILICA BRICK COMPANY (England).

A workman having been killed while working in a quarry, his widow claimed compensation from the company owning the quarry. It appeared that the deceased was paid by the company a fixed sum on each ton of stone sent out. He had taken another man into partnership, and they had under them several men who were employed by the day. The company provided the necessary tools, trans and rails, and also a horse. The deceased had to feed the horse and to

buy gunpowder from the company for blasting purposes. When the company's manager required a particular kind of stone, he gave orders for it, and he could order the refuse or *débris* to be removed to any particular place. The manager said that if the deceased had failed to do as instructed he would have received reasonable notice to terminate the contract. Subject to this, the deceased could work as he pleased, provided he did not damage the quarry. *Held*.—That there was evidence to support the finding of the County Judge that the deceased was a workman within the meaning of section 13 of the *Workmen's Compensation Act 1906*.

BOYD V. DOHARTY (England).

A was engaged to break stones for road metal at a fixed rate per cubic yard by B, who had a contract for the supply of road metal with a county road authority, and who provided A with material. A was injured whilst engaged on the work, and claimed compensation from B. The sheriff-substitute found that A was under B's orders as to where he should work, and was subject to dismissal by him. It was held that A was a workman.

REED V. SMITH, WILKINSON AND CO. (England).

The respondents were owners of a threshing machine which they let out on hire to farmers. They were bound by statute to have three men to attend the machine, two to look after the engine, and a third as a "road man." At farms the road man acted as assistant in the threshing, being paid for this by the farmer, and not by the respondents.

While engaged in the threshing the applicant, the "road man," was injured, and claimed compensation from the respondents, who denied liability, stating the farmer was employer.

The County Court Judge held the respondents were the employers.

The Appeal Court held: that the County Court Judge had decided a question of fact, and that there was evidence to support his decision.

ELTRINGHAM V. BROWN (Victorian case). Ballarat County Court, June, 1913.

Brown was the owner of a threshing machine in connexion with which he accepted contracts from farmers. Eltringham was employed by him on different farms. Whilst the machine was leaving the farm of one Allau, a mishap occurred at the gate of the farm. Eltringham went forward to check the wheel, and whilst doing so was injured. The Judge held that at the time of the accident Eltringham was not in the course of his employment, and therefore decided in favour of the employer.

NOTE.—This case is interesting from two points of view: First, the proprietor and not the farmer was unquestionably regarded as the employer; and secondly, the employment of the casual "followers" ceases when the machine commences to travel away from a farm. This decision is apparently justifiable and correct, and will form a precedent for the future.

Burnt lime may weigh from 70 lbs. to nearly 1 cwt. per bushel. Good lime is lightest.

In 1901-2 there were 23,535 tons of artificial manure used in Victoria. Nine years later the quantity was 86,316 tons.



VICTORIAN RAINFALL.

Second Quarter ; Year 1915.

During the second week of April some very appreciable falls of rain occurred in connexion with thunderstorms due to moonsoonal activity, and later an Antarctic depression passed over bringing good general rains to southern areas. These falls dispelled all anxiety south of the Dividing Range with regard to prospects for the coming season; but the amount of rain received in northern districts was not sufficient even for their present requirements. About the middle of the following month good general rains set in, and lasted about a week, followed by showers later. Some of the rivers then commenced to flow, and the droughty conditions disappeared—and one of the most severe droughts ever known in the history of the State terminated. The following month (June) was an exceedingly wet one; the rainfalls were extremely beneficial, and the days during which the falls continued were numerous. The heaviest rains occurred along the west coast and the Wimmera districts. The Southern Mallee fared much better than the northern parts, but East Gippsland did not participate to the same extent as the remainder of the State in the copious rains due to the Antares. All rivers and creeks throughout the State are now flowing, and crops growing well except in a few isolated cases, where early-sown crops are somewhat patchy. Grass is not growing up to anticipations, and the coldness of the weather had a very serious effect on stock, especially the poorly-conditioned and weak ones, many of which succumbed, they being too low to withstand the piercingly cold winds and the falling temperatures.

District.		April.	May.	June.	Quarter.
		Points.	Points.	Points.	Points.
Mallee North	District Mean	54	109	115	278
	Normal	74	100	151	325
	Per cent. above normal	..	..	..	..
	.. below ..	27	9	24	42
Mallee South	District Mean	70	124	193	387
	Normal	114	139	181	434
	Per cent. above normal	..	..	7	..
	.. below ..	39	11	..	43
North Wimmera	District Mean	99	141	333	573
	Normal	127	167	217	511
	Per cent. above normal	..	..	53	15
	.. below ..	22	16	..	..
South Wimmera	District Mean	98	158	517	773
	Normal	162	203	275	640
	Per cent. above normal	..	..	88	22
	.. below ..	40	22	..	..
Lower Northern Country	District Mean	80	206	206	492
	Normal	131	159	204	494
	Per cent. above normal	..	30	1	..
	.. below ..	39	..	..	8

VICTORIAN RAINFALL—continued.

District.		April.	May.	June.	Quarter.
		Points.	Points.	Points.	Points.
Upper Northern Country	District Mean.. ..	93	262	285	640
	Normal	165	204	271	640
	Per cent. above normal ..	..	28	52	36
	.. below ..	44	..	..	..
Lower North-East ..	District Mean.. ..	94	479	522	1,095
	Normal	197	240	383	820
	Per cent. above normal ..	..	100	36	84
	.. below ..	52	..	..	..
Upper North-East ..	District Mean.. ..	208	564	796	1,568
	Normal	274	366	609	1,249
	Per cent. above normal ..	..	54	31	61
	.. below ..	24	..	..	..
East Gippsland ..	District Mean.. ..	97	187	129	413
	Normal	253	241	319	813
	Per cent. above normal ..	..	..	..	..
	.. below ..	62	22	60	144
West Gippsland ..	District Mean.. ..	224	411	332	967
	Normal	299	278	351	928
	Per cent. above normal ..	..	48	..	18
	.. below ..	25	..	5	..
East Central ..	District Mean.. ..	357	460	348	1,165
	Normal	291	301	350	942
	Per cent. above normal ..	23	53	..	75
	.. below ..	..	..	1	..
West Central ..	District Mean.. ..	177	256	271	704
	Normal	201	207	224	632
	Per cent. above normal ..	..	24	21	33
	.. below ..	12	..	..	..
North Central ..	District Mean.. ..	176	320	418	914
	Normal	194	243	325	762
	Per cent. above normal ..	..	32	29	52
	.. below ..	9	..	..	..
Volcanic Plains ..	District Mean	153	228	377	758
	Normal	198	245	298	741
	Per cent. above normal ..	..	..	27	..
	.. below ..	23	7	..	3
West Coast ..	District Mean.. ..	177	346	671	1,194
	Normal	255	297	371	923
	Per cent. above normal ..	..	16	81	66
	.. below ..	31	..	..	..

N.B.—100 points = 1 inch.

H. A. HUNT,
Commonwealth Meteorologist.

22nd July, 1915.

SUMMARY OF RUTHERGLEN WEATHER.

C. Blazey, M.Sc. B. Ag.Sc. Field Officer, Rutherglen Experiment Farm.

These figures apply to years 1908-1915, *i.e.*, 7½ years, and are taken from the College Record Book.

Altogether there have been 650 wet days—an average of 86.66 per year.

In the following tables the direction of the wind is that given at 9 a.m. daily, and may be taken as indicating fairly the wind for the day. A difficulty arises when it is assumed that because the wind is recorded, say, as North at 9 a.m. on any particular day, the rain which has previously fallen has come from that direction. For instance, if, during the early morning, rain falls from the West, the wind may swing round to the south by 9 a.m. However, on the whole, the 9 a.m. wind record is a fair indication of the direction from which the preceding rain has fallen, as an examination of the Record Book shows:—

TABLE 1.

Number of days on which rain has fallen from the following directions:—

S.E.	E.	N.E.	N.	N.W.	W.	S.W.	S.
82	32	338	14	29	23	87	22

TABLE 2.

Total rain from following directions (points):—

S.E.	E.	N.E.	N.	N.W.	W.	S.W.	S.
Total number of points.							
1,594	865	8,524	400	1,000	625	2,057	241
Percentage of total rain.							
10.4%	5.65%	55.66%	2.67%	6.53%	4.08%	13.43%	1.57%

TABLE 3.

Average fall in points from following directions, and number of falls over 1 inch and 50 points:—

S.E.	E.	N.E.	N.	N.W.	W.	S.W.	S.
Average fall in points (for one day).							
19.4	16.6	25.2	29.2	34.5	24.0	23.6	11.0
Falls of more than 1 inch for one day.							
—	1	11	1	2	1	3	—
Falls of more than 50 points for one day.							
8	5	54	3	8	4	10	1

TABLE 4.

Average monthly fall in inches:—

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1.14	1.08	2.28	1.20	2.03	2.82	2.14	1.73	1.78	1.63	1.64	1.28

Average yearly fall, 20.75.

SUMMARY.

1. In every month most of the rain comes from the N.E.
2. For the last seven and a half years nearly 58 per cent. of the rainfall has been from this direction.
3. In summer, wind from the E. or N.E. means warm (hot) weather, and rising temperatures. Heavy rains come from the N.E. both summer and winter.
4. Wind from the N.W., W. or S.W. often means boisterous weather summer and winter. Rain from these quarters is generally showery. In summer, when the wind gets round to the S. W. or S., the temperature generally drops.
5. Easterly rains are few and light. At Beechworth, Tallangatta, &c., rains from this direction are often heavy, but seldom reach Chiltern or Rutherglen.

VICTORIAN AGRICULTURAL STATISTICS.

AREA UNDER OATS, 1915-16.

Estimated Area under Oats, Season 1915-16 (based on information furnished by Farmers).

Counties.	Area under Oats (Grain and Hay), 1914-15.	Estimated Area under Oats (Grain and Hay), 1915-16.
	Acres.	Acres.
Bourke	83,990	96,800
Grant	110,015	133,500
Dalhousie	21,494	26,100
Talbot	43,491	53,600
Grenville	37,279	44,200
Ripon	35,677	39,800
Lowan	76,463	83,900
Berung	109,851	108,700
Kara Kara	45,009	55,400
Karkaroc	54,921	43,100
Tatchera	36,042	41,400
Gunbower	24,912	33,600
Gladstone	33,755	48,300
Bendigo	30,962	50,200
Rodney	29,936	44,300
Moir	39,562	59,900
Delatite	27,757	30,000
Bogong	26,517	29,900
Bulu Bulu	34,635	43,600
Other counties	203,412	251,700
Total	1,112,710	1,324,000
Grain area, 1914-15	434,815	..
Hay area, 1914-15	677,895	..

VICTORIAN AGRICULTURAL STATISTICS-- *continued.*

AREA UNDER WHEAT, 1915-16.

Estimated Area under Wheat, Season 1915-16 (based on information furnished by Farmers).

Counties.	Actual Area under Wheat (Grain and Hay), 1914-15.	Estimated Area under Wheat (Grain and Hay), 1915-16.
	Acres.	Acres.
Grant	16,675	32,800
Tallbot	31,296	44,200
Grenville	34,653	46,500
Hampden	22,461	30,800
Ripon	77,683	99,700
Lowan	201,350	264,300
Borong	407,549	594,700
Kara Kara	168,820	229,200
Weeah	181,192	231,300
Karkaroc	500,708	649,200
Tatchera	338,113	473,400
Gimbower	66,760	88,300
Gladstone	159,705	208,300
Bendigo	198,105	257,100
Rodney	163,925	205,900
Moir	358,149	506,300
Delatite	19,651	33,000
Bogong	54,339	72,000
Other counties	54,933	91,800
Total	3,056,097	4,160,800
Grain area	2,863,535	3,810,800
Hay area	192,562	350,000

Stocks of Wheat and Flour in Victoria on 30th June, 1915, compiled from information received from Holders.

Where Located.	Wheat.	*Flour (Equivalent in Wheat).	Total
	Bushels.	Bushels.	Bushels.
On railway stations and in transit	15,427	14,200	29,627
On sites leased from railways	120,164	49,700	169,864
In mills and stores (other than those on railway premises)	234,852	446,400	681,252
On farms	212,005	..	212,005
Total	582,448	510,300	1,092,748

* Exclusive of quantities held in small bakeries and by store-keepers.

VICTORIAN AGRICULTURAL STATISTICS—continued.

AREA AND PRODUCE OF POTATOES, ONIONS, AND MAIZE, 1913-14 AND 1914-15.

Principal Counties.	Area in Acres.		Produce.			
			Total.		Average per Acre.	
	1913-14.	1914-15.	1913-14.	1914-15.	1913-14.	1914-15.
<i>Potatoes.</i>						
			Tons.	Tons.	Tons.	Tons.
Bourke	7,951	6,508	18,307	15,176	2·30	2·33
Grant	10,557	8,898	23,942	24,848	2·27	2·79
Mornington	11,276	12,372	31,209	45,334	2·77	3·66
Evelyn	1,388	1,542	3,092	4,078	2·23	3·04
Dalkousie	3,840	3,228	6,239	7,609	1·62	2·36
Talbot	8,872	6,804	15,269	17,669	1·72	2·60
Grenville	1,648	1,063	3,174	3,012	1·93	2·83
Polwarth	1,354	1,306	3,004	2,947	2·26	2·26
Ripon	1,953	1,344	2,595	2,591	1·33	1·93
Villiers	5,708	5,392	20,870	15,347	3·66	2·85
Normanby	2,475	1,926	6,097	4,117	2·46	2·14
Delatite	1,380	1,198	2,624	1,861	1·90	1·53
Bulu Bulu	8,031	8,393	23,173	34,794	2·89	4·15
Remainder of State ..	8,141	5,721	16,947	9,842	2·08	1·72
Total	74,574	65,495	176,602	189,225	2·37	2·89
<i>Onions.</i>						
			Tons.	Tons.	Tons.	Tons.
Bourke	1,118	1,157	4,014	4,117	3·59	3·56
Grant	740	1,199	2,405	3,116	3·25	2·69
Mornington	547	1,244	2,407	5,794	4·40	4·66
Grenville	1,570	2,134	5,636	4,826	3·59	2·26
Polwarth	594	803	3,065	2,737	5·16	3·41
Villiers	609	1,039	3,483	3,688	5·72	3·59
Bulu Bulu	566	937	2,168	6,072	3·83	6·48
Remainder of State ..	377	424	1,577	1,178	4·18	2·78
Total	6,121	8,937	24,755	31,528	4·04	3·53
<i>Maize.</i>						
			Bushels.	Bushels.	Bushels.	Bushels.
Delatite	1,095	1,120	28,076	13,328	25·64	11·90
Begone	974	1,088	21,525	15,820	22·10	14·54
Crooklinglong	2,121	3,023	114,789	218,986	54·12	72·41
Tambo	3,144	3,311	195,840	248,789	62·29	75·14
Jargo	4,015	3,556	177,102	209,113	44·11	58·80
Tanjil	4,960	5,056	209,461	260,589	42·23	51·54
Bulu Bulu	379	502	13,401	20,391	35·30	40·62
Remainder of State ..	1,271	1,777	40,335	31,106	31·66	17·50
Total	17,962	19,433	800,529	1,018,419	44·57	52·41

FIFTH VICTORIAN EGG-LAYING COMPETITION, 1915-1916.

Commenced 15th April, 1915; concluding 14th April, 1916.

CONDUCTED AT THE BURNLEY SCHOOL OF HORTICULTURE.

Six Birds. Pen No.	Breeds.	Owner.	Totals.			Position in Competition.
			15. 4. 15 to 14. 8. 15	15. 8. 15 to 14. 9. 15	Five months.	
LIGHT BREEDS.						
Wet Mass.						
53	White Leghorns	W. G. Swift	505	155	660	1
21	"	E. B. Harris	511	146	657	2
38	"	G. McDonnell	503	145	648	3
19	"	L. G. Broadbent	489	157	646	4
5	"	J. J. West	484	154	638	5
2	"	E. A. Lawson	490	144	634	6
34	"	H. McKenzie and Son	472	153	625	7
8	"	C. J. Jackson	467	143	610	8
10	"	A. E. Tuttleby	461	145	606	9
42	"	W. M. Bayles	456	147	603	10
9	"	J. Schwabb	462	137	599	11
6	"	F. Doldissen	460	137	597	12
7	"	Marville Poultry Farm	459	136	595	13
26	"	A. Mowatt	441	144	585	16
16	"	N. Burston	456	129	585	
44	"	Mrs. F. M. Oliver	433	143	576	17
18	"	D. Adams	444	123	567	18
4	"	R. Hay	423	133	556	19
30	"	A. E. Silbereisen	410	142	552	21
32	"	F. Hodges	419	133	552	22
60	"	H. C. Brock	418	132	550	23
39	"	W. M. Sewell	396	152	548	24
1	"	Mrs. H. Stevenson	402	141	543	25
50	"	John Hood	403	130	533	26
25	(5 birds)	Giddy and Son	415	118	533	27
11	"	J. B. Bridgen	390	141	531	28
3	"	J. H. Gill	386	141	527	29
54	"	W. G. (Ingin)	374	153	527	30
24	"	Lysbeth Poultry Farm	389	137	526	31
59	"	W. G. Osborne	371	151	522	32
49	"	Bennett and Chapman	392	127	519	33
13	"	T. Hustler	372	140	512	34
33	(5 birds)	A. W. Hall	379	133	512	35
23	"	R. Lethbridge	378	133	511	36
48	"	Fulham Park	372	136	508	37
15	"	C. J. Beatty	364	143	507	38
55	"	H. N. B. Mirams	378	119	497	39
57	"	W. N. O'Mullane	354	139	493	40
47	"	B. Mitchell	360	118	478	41
52	"	J. C. Armstrong	331	137	468	42
29	"	A. A. Sandland	349	118	467	43
20	"	R. W. Pope	321	144	465	44
27	"	J. A. Stahl	307	152	459	45
43	"	H. I. Merrick	336	115	451	46
12	"	G. Hayman	305	141	446	47
58	"	Thirkell and Smith	313	131	444	48
41	"	J. A. Donaldson	315	126	441	49
45	"	South Yan Poultry Farm	318	121	439	50
36	"	Weldon Poultry Yards	319	113	432	51
46	"	R. Berry	300	130	430	52
22	"	S. Buscumb	280	149	429	53
40	"	C. C. Dunn	314	114	428	54
37	"	A. Ross	277	122	399	55
14	"	W. Flood	305	73	378	56
56	(5 birds)	C. Hurst	259	113	372	57
31	"	L. McLean	196	125	321	58
Total			21,683	7,554	29,237	

FIFTH VICTORIAN EGG-LAYING COMPETITION, 1915-16—continued.

Sex Birds.	Breeds.	Owner.	Totals.			Position in Competition.
			15.4.15 to 14.8.15.	15 8 15 to 14 9 15.	Five months.	
LIGHT BREEDS.						
DRY MASH.						
80	White Leghorns ..	W. H. Robbins ..	561	132	713	1
68	" ..	H. McKenzie and Son ..	423	151	574	2
69	" ..	E. MacBrown ..	430	123	553	3
78	" ..	H. Hanbury ..	429	127	556	4
64	" ..	W. M. Bayles ..	419	135	554	5
79	" ..	Lysbeth Poultry Farm ..	393	148	541	6
72	" ..	Mrs. F. Zimmerman ..	394	138	530	7
66	" ..	E. A. Lawson ..	376	147	523	8
63	" ..	A. H. Padman ..	349	158	507	9
76	" ..	A. A. Sandland ..	363	140	503	10
65	" ..	Thirkell and Smith ..	339	135	474	11
62	" ..	Benwerron Egg Farm ..	313	163	476	12
61	" ..	Mrs. H. Stevenson ..	301	157	458	13
97	" ..	C. C. Dunn ..	318	135	453	14
71	" ..	Moritz Bros. ..	320	128	448	15
77	" ..	South Yan Yean Poultry Farm ..	218	141	359	16
73	" ..	C. L. Lindrea ..	200	153	353	17
74	" ..	J. H. Gill ..	240	107	347	18
75	" ..	Fulham Park ..	237	91	328	19
Total			6,613	2,614	9,257	
HEAVY BREEDS.						
WET MASH.						
97	Black Orpingtons ..	Marville Poultry Farm ..	507	156	663	1
90	" (5 birds) ..	J. H. Wright ..	524	134	658	2
86	" ..	C. E. Graham ..	476	173	649	3
81	" ..	Mrs. T. W. Pearce ..	513	129	644	4
85	" ..	H. H. Pump ..	445	147	592	5
90	" (5 birds) ..	Oaklands Poultry Farm ..	455	141	596	6
88	" ..	J. McAllan ..	420	150	570	7
94	" (5 birds) ..	D. Fisher ..	450	117	567	8
89	Rhode Island Reds ..	E. W. Hippe ..	413	149	562	9
93	Black Orpingtons ..	L. W. Parker ..	390	155	545	10
99	" ..	L. McLean ..	392	147	539	11
87	" ..	W. C. Spencer ..	390	143	533	12
91	" ..	A. Greenhalgh ..	366	124	490	13
84	" ..	Cowan Bros. ..	352	131	483	14
95	Silver Wyandottes ..	W. H. Forsyth ..	351	124	474	15
92	Black Orpingtons ..	J. Ogden ..	308	145	453	16
96	White Orpingtons ..	Stranks Bros. ..	349	81	430	17
83	Black Orpingtons ..	G. Mayberry ..	272	114	386	18
98	Faverolles ..	K. Courtenay ..	226	134	360	19
82	White Wyandottes ..	J. B. Bridgen ..	104	128	232	20
Total			7,705	2,681	10,386	

Report for Month Ending 14th September, 1915.

The weather conditions for the month were seasonable, a great deal of north-west wind with light rains alternating with fine, clear days. The birds are in excellent condition, and laying very fast. (The week ending 16th September was the highest figures for one week's laying yet done at Burnley.) One hen died during the month, and a number were broody. The rainfall for the month was 174 points.

Department of Agriculture,
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A. HART,
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ORCHARD AND GARDEN NOTES.

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The Orchard.

CULTIVATION.

Orchard ploughing should now be finished, and the main work for the next few months will be an endeavour to keep the soil surface loose, friable, and well opened. The consolidation of the surfaces must be avoided, as a hard, compact surface means the loss of much soil moisture by means of capillary attraction. So that, after rains, heavy dews, spray pump, and other traffic, it will be desirable to run the harrows through the orchard, to keep the surface well broken, and so as to obtain a good earth mulch. If, after ploughing, it be found that the surface is cloddy, and that the harrows will not break the clods down, the soil must be well rolled with a spike or an ordinary round roller, and then afterwards harrowed.

Green manure crops should now be ploughed under; if these crops are at all abundant in growth, they should be well rolled or dragged down with a chain, or they should be run over with a disc. Any of these means will assist in getting the whole of the crop underground, which is a desideratum.

In addition to the retention of soil moisture, cultivation of the orchard will suppress all weeds, which rob the trees of both water and food. The suppression is an important work in the spring and early summer, and weeds should be rigorously hoed or cultivated out.

SPRAYING.

Peach aphid will be claiming attention, as it will now be present in full force, if no winter spraying has been carried out. The spray for the present time is a strong nicotine solution, to be sprayed frequently, so long as the insects are present.

As apple and pear blossoms are bursting, the trees should be sprayed with Bordeaux mixture for Black Spot. If this has been delayed, the sulphate of copper may be added to the first arsenate of lead spray, for codlin moth, using 1 lb. of copper sulphate to 50 gallons of the spray.

As soon as the apple and pear blossoms drop, it is time to prepare the arsenate of lead spraying against the larvæ of the codlin moth. Early applications are necessary; and one or two applications at the beginning of the season, while the apples are growing quickly, will be very efficacious.

GENERAL.

Grafts on young and old trees will need constant observation; they must not be allowed to become too dry; the sap and growth must not be restricted by the ties; and, if the growths become unduly long, they should be pinched back to make the growths sturdy. The foliage will always be benefited by a water spraying when the weather is hot, dry, or windy.

Citrus trees may be planted out; watering at planting and giving the foliage an occasional water sprinkling will be beneficial to the young trees.

Vegetable Garden.

The surface soil requires to be well pulverized at this time of the year; it should be kept well hoed, especially after the necessary frequent waterings, and all weeds must be suppressed. Apart from their harmfulness in robbing plants of food and moisture, the weeds, if allowed to remain and seed, become a menace to future economical work.

The top dressing and weeding of asparagus beds will now be necessary; the beds should be well cut over as often as necessary, removing all growths, small and large. It is a mistake to allow the small stems to grow on, because they may be too small for cutting.

Planting of tomatoes may now be carried out; all early planted plants should be fed, staked, and the laterals pinched out. A little bonedust or superphosphate may be given, but these are not equal to animal manures, if the latter are available. Chemical manures should only be given in a limited quantity; 6 cwt. or 7 cwt. per acre would be a heavy dressing, and this works out at nearly 3 ozs. per square yard. Vegetable-growers may easily try this for themselves, and it will soon be seen that 3 ozs. scattered over a square yard of surface will appear to be a very light dressing.

French beans, carrot, parsnip, celery, radish, peas, and turnip seed may now be sown. Seeds of cucumber, melon and pumpkin family, may now be sown in the open ground. All seedlings may be transplanted on favorable days, and it will be well to sprinkle the tops when planting out, as well as to water the roots.

Flower Garden.

As in other sections, there should be no clods on the surface, the soil should be friable, and no surface cracking should be allowed. As often as a watering is given, so a hoeing should succeed this work. Flowering plants suffer exceedingly through loss of soil moisture, and hard and compact surfaces are detrimental to their successful growth. It is always helpful to plants, and especially so on hot, sunny and windy days, to have the surface well hoed. In addition to conserving the soil water, it creates cool soil conditions, which are so helpful to good root action at this season of the year. Hoeing also keeps down the weeds, which need keeping down, and which should not be allowed to seed in the beds.

Roses will need attention, as both rose aphids and mildew will be making their appearance. For the former, strong tobacco and soap sprays, pine spray, benzole emulsion, and soaperine are all very helpful in its eradication. For mildew, the plants should be dusted with sulphur when the foliage is moist, a dusting of sulphur on the ground under the bushes will be useful, as the fumes will be helpful in checking the fungus. All leaf-eating insects on any plants may now be suppressed with arsenate of lead or Paris green.

Beds should be well dug over in preparation for chrysanthemum or dahlia planting; if these plants are not to be grown in separate beds, a few may be planted out for early flowering.

Bulbs that have finished flowering, and that have lost their foliage, should be lifted and stored. The foliage must not be cut off while it is still green, as this means loss of sap and energy.

Tender and half-hardy and other annuals may be planted out for summer and autumn flowers. These include asters, zinnias, salvias, balsams, amaranthus, celosias, &c., lobelia, bedding begonias, iresines, and alternantheras may also be planted in the beds and borders.

REMINDERS FOR NOVEMBER.

Live Stock.

HORSES.—Continue to feed stable horses well; add a ration of greenstuff, Rug at night. Continue hay or straw, chaffed or whole, to grass-fed horses. Feed old and badly-conditioned horses liberally. If too fat, mares due to foal should be put on poorer pasture. Turn out workers due for a spell at grass. In view of sand trouble this year horses which have been paddocked all the winter should not be put to work until properly conditioned and any sand accumulation got rid of. A course of three or four bran mashies, after a twelve hours' fast, followed by 1 to 1½ pints of linseed oil, is helpful. Repeat in two or three days, if necessary. Colts to be gelded should be operated on before hot weather sets in.

CATTLE.—Except on rare occasions, rugs may now be used on cows on cold and wet nights only. Continue giving hay or straw. Beware of milk fever. Read up method of treatment in *Year-Book of Agriculture*, 1905. Have cows' milk weighed and tested for butter fat. Rear heifer calves from cows giving satisfactory results. Give calves a warm dry shed and a good grass run. Keep calves' premises scrupulously clean and regularly disinfected with Phenyle or Condyl's Fluid. Feeding vessels must be kept clean. Skim milk should be scalded, unless it is known that the cows are healthy. Give the calves a regular quantity, and do not overfeed. Better too little than too much. Give milk at blood heat. Dehorn all calves, except those required for stud or show purposes.

PIGS.—Supply plenty of bedding in well-ventilated styes. Keep styes clean and dry, and feeding troughs clean and wholesome. Sows may now be turned into grass run. Read articles on breeding and feeding and housing in *Journals*, April, 1912, June, 1913, and May, 1915.

SHEEP.—Prepare for dipping. Ascertain exact contents of bath before mixing. Powder or paste dips have the most lasting effect, particularly where the lice have been bad. Hold sheep in the bath not less than half a minute; if badly infested, longer. Submerge heads twice, but allow them to rise quickly—most deaths after dipping are due to gross carelessness in holding sheep under too long, the dip wash being taken in on to the lungs. Dip full grown sheep first, lambs last. Yard sheep over night. Dip while empty, and avoid fouling the drainer so much. Commence early in the day, and allow sheep to dry before nightfall. Avoid travelling long distances to and from baths, and dipping sheep while overheated. Do not roughly throw sheep in. Avoid filthy baths; this increases a dead tip in hot areas.

POULTRY.—Provide plenty of green food and shade. Watch for vermin; spray crevices of perches and houses with crude carbolic acid, 1 in 50. Keep water clean and cool and out of the sun. One packet of Epsom salts should be given to thirty birds through the mash. Remove all male birds from the flock. Infertile eggs are preferable when pickling, or when placed in cool storage.

Cultivation.

FARM.—Plant main crop of potatoes. Cut hay and silage. Weed early potatoes. Sow maize and millets. Weed tobacco beds, and water, if dry.

ORCHARD.—Ploughing, harrowing, and cultivating to be continued. Weeds to be kept down. Secure, pinch, and spray grafts with water. Spray frequently for codlin moth, pear and cherry slug, and peach aphid. Plant out citrus trees.

VEGETABLE GARDEN.—Hoe and mulch surface. Suppress weeds. Water where dry and hoe afterwards. Disbud and pinch back tomato plants. Sow celery, French beans, peas, lettuce, cucumber, melon, &c., seeds.

FLOWER GARDEN.—Water and mulch. Cultivate and keep down weeds. Thin out weak wood from roses. Prune early all flowering shrubs that have finished flowering. Lift and store bulbs. Plant out dahlias and chrysanthemums. Liquid-manure herbaceous perennials.

VINEYARD.—Field grafts require careful attention in the way of removal of suckers and seion roots. Cultural work, such as scarifying and hoeing, should be actively pushed forward, so as to provide as good a "mulch" as possible during summer. Proceed with tying up, stopping and topping. Avoid excessive topping, summer pruning being usually more injurious than useful in warm, dry climates. Cincture Zante currant vines after flower caps have fallen. Apply second sulphuring just before blossoming, wherever Oidium was prevalent last year.

Cellar.—Same as last month.